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# COASTAL EROSION AND ARCHEOLOGICAL RESOURCES ON NATIONAL WILDLIFE REFUGES IN THE SOUTHEAST

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**Prepared by:**
**Archeological Services Branch**
**National Park Service**
**Atlanta, Georgia**

**Funded by:**
**U.S. Fish and Wildlife Service**
**Southeastern Region**
**Atlanta, Georgia**

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# FOREWORD

Coastal erosion confronts the resource manager with a no win situation in which you are damned if you do and damned if you don't. Erosional effects, whether natural or man-induced, are taking their destructive toll on archeological resources at an alarming rate, yet the treatments can have severe impacts on a site's integrity without providing any guarantees for long-term protection. The conservation ethic is thus compromised. The cure can be worse than the disease if the protective measures require the destruction of a large part of the site to achieve some measure of short-term stability.

On the other hand, given the high cost of protection, the lack of proven measures, and the costs associated with continuous monitoring, to implement a deliberate program of data recovery may be the most viable alternative. An approach that has traditionally been viewed as a last resort from a management and research point of view then becomes the most attractive option.

These are the conflicts that Susan Garrett has grappled with in this study of erosional threats to archeological sites on coastal refuges. Her presentation is straightforward and direct, and its simplicity attests to the success she has had in synthesizing a mass of data on archeology and erosion from the Maritime Provinces to the Gulf of Mexico. Unfortunately, the solutions are not so simple. A site-by-site approach to the problem of erosion can be wasteful and shortsighted. Rational decisions about which sites to protect or what protective measures to use should only be made in context of what is known about the overall coastal resource base and the priorities outlined in a comprehensive planning framework.

This study is the first in a series of problem-oriented projects to be undertaken by the Archeological Services Branch of the Atlanta office of the National Park Service and designed to provide comprehensive programmatic assistance to Federal agencies. The research is broad-based and the results and recommendations are applicable to all Federal agencies with coastal holdings. It is hoped that the findings can be utilized by agencies working in tandem to address the specific issues that are highlighted in the report and thus bring more efficiency to the overall national archeological effort. It is a small initial step in an attempt to institutionalize cultural resource considerations as part of the total resource management process. The U.S. Fish and Wildlife Service is to be commended for its initiative in bringing to light the concern and for its willingness to fund the study.

Victor A. Carbone
Chief, Archeological Assistance Division
National Park Service
Washingtion, D.C.

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## ACKNOWLEDGMENTS

> "Calling to mind with gratitude those to whom we are indebted is not only a sort of piety, but one of the few pleasures that endure without loss of luster to the end."
>
> -William Alexander Percy
> Lanterns on the Levee

It is a true pleasure to thank the many people who gave shape to this report. My special thanks go to Mr. James E. Cobb, Regional Archeologist, U.S. Fish and Wildlife Service, Southeastern Region, for his near infinite patience and his insightful comments on numerous earlier drafts; Dr. Victor A. Carbone and Mr. Edwin Hession of the Archeological Services Branch of the National Park Service for their support and editorial guidance; and Dr. J. Raymond Williams of the University of South Florida. Mr. Don Adams, Chief of Program Development (Wildlife), Southeastern Region, U.S. Fish and Wildlife Service, was instrumental in the inception of this project, and was helpful throughout in answering many of my questions. John Davis, Gary Heet, Glen Carowan, and Jerre Gamble, also with the Fish and Wildlife Service, were especially kind in showing me various refuges.

Individuals who gladly shared their knowledge and expertise, and thus contributed to the content of the report, include Louis Tesar of the Florida Division of Archives, History, and Records Management; Dr. Christopher Turnbull, Provincial Archeologist, New Brunswick, Canada; Dr. Arthur Spiess, Maine Historical Preservation Commission; Dr. Roger Saucier, Waterways Experiment Station, U.S. Army Corps of Engineers; Dr. Reynold Ruppe, Arizona State University; Dr. Robert Thorne, Center for Archeological Research, University of Mississippi; Dr. David Sanger, University of Maine; Dr. Prentice Thomas, New World Research Inc.; Mr. Stanley Riggle, Advisory Council on Historic Preservation, Denver Office; Ms. Daphne Derven, Mr. Roy Eichorn, and Mr. Larry Banks of the U.S. Army Corps of Engineers; and Mr. George Luer. The State Historic Preservation Offices of North Carolina, Florida, Alabama, Louisiana, and Mississippi provided valuable site data. Dr. Nancy White and Dr. Roger Grange, both of the University of South Florida, commented on earlier drafts, and Linda H. Worthy edited the final draft.

My supervisory archeologist was Mr. Wilfred Husted of the Archeological Services Branch, National Park Service. Seth Fallick drafted the figures, and the cover photograph was taken by Larry C. Huston. My thanks also go to the many other persons, not individually named, who also helped in this project.

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# ABSTRACT

The Southeastern Region of the U.S. Fish and Wildlife Service manages a number of refuges on which coastal erosion is the major destructive force acting on archeological resources. In the past, the lack of knowledge about the resources being damaged or about the extent of erosional damage has precluded the Service from developing a regional preservation plan for these resources. This report summarizes the known information on prehistoric resources in each of the coastal refuges in the Southeast, and provides a basis for decision-making concerning the treatment of these resources.

The study also takes an in-depth look at preservation as a treatment measure for eroding sites. The use of erosion control measures as a treatment option has become fairly common along reservoir or lake shorelines, but is still rare in the coastal zone. Potentially useful control measures, including structural measures such as bulkheads, seawalls, and revetments, and non-structural measures such as vegetation, are discussed in terms of their applicability to archeological sites, their durability, and their cost-effectiveness in comparison to data recovery. The information should be applicable to any Federal, State, or local agency that has responsibility for cultural resources in a coastal area, and it is hoped that experimentation with erosion control measures will ensue. Much of the coastal archeological record has already been destroyed by the combined forces of natural and human-induced erosion, and alternative ways of preserving the remaining record are needed.

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## TABLE OF CONTENTS

Foreword i

Acknowledgments iii

Abstract v

List of Figures ix

List of Tables xi

Chapter I: Introduction 1

Chapter II: Natural Setting and Description of Study Area 5

Chapter III: Coastal Geomorphology 15

Chapter IV: Coastal Prehistory 23

Chapter V: Erosion: Cause and Control 37

Chapter VI: Management Recommendations 51

References Cited 61

Appendix A: Known Prehistoric Resources in Coastal Wildlife Refuges, Southeastern Region 79

Appendix B: Recommended Work for Coastal Wildlife Refuges, Southeastern Region 123

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# LIST OF FIGURES

| | | Page |
|---|---|---|
| Figure 1 | The southeastern United States, showing the Coastal Plain and Continental Shelf. | 6 |
| Figure 2 | The Embayed section of the Coastal Plain, showing locations of the National Wildlife Refuges. | 7 |
| Figure 3 | The Sea Islands section of the Coastal Plain, showing locations of National Wildlife Refuges. | 8 |
| Figure 4 | The Floridian section of the Coastal Plain, showing locations of the National Wildlife Refuges. | 10 |
| Figure 5 | The East Gulf Coastal Plain, showing locations of National Wildlife Refuges. | 12 |
| Figure 6 | The Mississippi Alluvial Plain and the West Gulf Coastal Plain, showing locations of National Wildlife Refuges. | 13 |
| Figure 7 | Contours of the Florida peninsula, showing exposure of land at 12,000, 11,000, and 6500 B.P. (After Ballard and Uchupi 1970) | 17 |
| Figure 8 | Drowned beach ridge theory of barrier island formation. (From Hoyt 1967) | 19 |
| Figure 9 | Spit theory of barrier island formation. (From Hoyt 1967) | 19 |
| Figure 10 | Shired Island West site (8 Di 7), showing erosional damage. | 39 |
| Figure 11 | Bayside exposure of Cash Mound (8 Ch 38) in the Island Bay Refuge. | 40 |
| Figure 12 | Diagram of seawall constructed at the Ministers Island site in New Brunswick, Canada. (From Ferguson and Turnbull 1980) | 44 |
| Figure 13 | Construction of seawall at Ministers Island. (Photo courtesy of Christopher Turnbull, Provincial Archaeologist, New Brunswick) | 45 |

Figure 14 Bulkhead protecting property at the Shiloh National Park and Cemetery, Tennessee. (Photo courtesy of John Wilburn, National Park Service) 46

Figure 15 Profile of a revetment, showing armor layer, filter layer, and toe protection. (*After* U.S. Army Corps of Engineers 1981) 47

Figure 16 Rock revetment at the Fernald Point site in Acadia National Park, Maine. (Photo courtesy of David Sanger, University of Maine) 48

Figure 17 Model of cultural resource planning process. (*Adapted from* Aten 1982) 53

# LIST OF TABLES

Page

Table 1 Known Prehistoric Resources in Coastal Wildlife Refuges, Southeastern Region. 80

Table 2 Recommended Work in Coastal Wildlife Refuges, Southeastern Region. 124

# CHAPTER I

## INTRODUCTION

The U.S. Fish and Wildlife Service manages 37 coastal wildlife refuges in the Southeast. Within these refuges, coastal erosion, whether by normal tidal action or by human-induced erosional patterns, is a major destructive force operating on many archeological sites. In the past, the lack of knowledge about the threatened resources or about the extent of erosional damage has precluded a unified management policy for these resources on the part of the Fish and Wildlife Service. Approximately two-thirds of the coastal refuges in the Southeastern Region have undergone some form of archeological investigations in the last five years, with over 30 separate reports having been produced. Until now, the refuge reports were scattered, no synopsis of them existed, nor had they been placed in a larger, regional framework. This study critically summarizes the material presented in the reports, summarizes the available data on the nature and extent of erosional damage to archeological sites, and examines treatment options, particularly the use of erosion control measures, in the preservation of eroding coastal sites. From this emerges a preliminary basis for decision-making concerning the management and treatment of the Service's prehistoric archeological resources in its coastal refuges, together with recommendations for implementing a cultural resource planning process within the refuge system.

To provide a regional framework for planning decisions, a summary of the prehistoric occupation of the Southeast, from humankind's earliest occupation of the area to the period of Amerindian-European contact, is presented. The prehistoric cultures of the southeastern coast, occupying the narrow, serpentine zone between land and sea, were very much a part of the overall cultural development in the Southeast, yet show intriguing and distinctive adaptations peculiar to their littoral settings.

Regrettably, many archeological sites that could have contributed to our understanding of coastal adaptations have already been destroyed. The coast was one of the first areas to be visited by explorers and populated by early colonists. Later, the coast was attractive to early antiquarians who, while providing us with an invaluable record of cultural resources, often destroyed the mounds and middens they investigated. Today coastal areas show accelerated change as commerical development proceeds at twice the rate of inland areas. But, both past and present, one of the major destructive agents acting on archeological sites in the littoral zone has been the natural modification of coastal areas in response to geological, hydrological, and climatic forces. If sea level continues to rise at predicted rates, the destruction of archeological sites by these natural forces will accelerate.

A study of coastal geomorphology and coastal dynamics as they affect archeological sites forms a cardinal component of this report. The coastal refuges of the Southeastern Region represent a wide variety of landforms of different origins, ranging from Holocene barrier islands to Pleistocene mainland terraces, relict spits, lagoons, and stream estuaries. An understanding of how these environments were formed is necessary to the development of a rational cultural resource management plan. Likewise, an understanding of the causative forces behind erosion is required in order to accurately assess the nature and extent of present and future erosional damage.

Perhaps the most important aspect of this study is the material presented on erosion control measures for archeological sites in the shore zone. The use of erosion control measures as a treatment option for significant sites has become increasingly common along reservior or lake shorelines in the United States in recent years. However, in littoral areas, where climatic, geological, and hydrological forces are especially complex, the use of erosion control as an archeological site conservation measure is rare, and is still very much in the experimental stage. Potentially useful control measures, including structural measures such as bulkheads, seawalls, and revetments, and non-structural measures such as vegetation, are discussed in terms of their applicability to archeological sites their durability, and their cost-effectiveness in comparison with data recovery.

For the Fish and Wildlife Service, decisions concerning treatment of eroding coastal sites must be based on explicit regional priorities. These priorities should be set during a formal process of cultural resource planning that stresses the review of existing information and the accumulation of new data in response to established needs. The majority of the region's coastal refuges have high potential for significant cultural resources, but very few of these refuges have yet been adequately surveyed. Of the surveyed refuges, approximately 40 percent have known resources that may be significant, but which lack testing and evaluation to determine their eligibility for listing on the National Register of Historic Places. Finally, of the nearly 500 known sites in the the coastal refuges, over 100 are being adversely affected by erosion. Many more eroding sites are undoubtedly present on the refuges, but have not been recorded since most archeological surveys have avoided the coastline or marsh areas where eroding sites are likely to be found. To fill the gaps in the data and provide the information necessary for decision-making, the Fish and Wildlife Service needs to implement a systematic program of inventory, evaluation, and treatment of eroding sites within the refuge system. Priorities for action should be based on the probable degree of significance of sites or groups of sites, and on the severity of threat to the resources.

Appendices A and B, integral parts of this study, provide a first attempt at planning for the Southeastern Region's coastal refuges. In summary format, Appendix A furnishes information on the known prehistoric cultural resources in the region and provides estimates of the potential for significant cultural resources on each refuge. Appendix B takes this information and suggests priorities for future archeological investigations. However, cultural resource management is a continuous process, and plans and priorities will change in response to new information. Data gained in the future should be added to the framework devised in this study to improve the model and provide a more refined basis for decision-making.

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# CHAPTER II

## NATURAL SETTING AND DESCRIPTION OF STUDY AREA

The coastline encompassed by the Southeastern Region of the U.S. Fish and Wildlife Service extends from the upper reaches of North Carolina to southwestern Louisiana, a distance of over 14,000 miles. The area is part of the Atlantic Plain, a broad, seaward tilting formation of sedimentary deposits formed during the Tertiary and Quaternary periods. The submerged portion is known as the Continental Shelf (Fenneman 1938). The emerged portion, known as the Coastal Plain, rises from the current sea level to elevations of several hundred feet where it adjoins older rock formations of mountainous zones. Climatically, the southeastern coast is characterized as tropical south of a line from Cape Canaveral on the Florida east coast to Charlotte Harbor on Florida's west coast, and humid subtropical north of the line. In tropical climates, the average temperature of each month is over 64.4° F (18° C), with no discernible winter season, while in subtropical climates there is an alternating winter and summer season.

Physiographically, the Coastal Plain may be divided into a number of smaller sections. These are the Embayed section, the Sea Islands section, the Floridian section, the East Gulf Coastal Plain, the Mississippi Alluvial Plain, and the West Gulf Coastal Plain (Fenneman 1938) (Figure 1).

The Embayed section is the northernmost section of the Coastal Plain (Fenneman 1938). The coasts in this section are microtidal, which means they have a spring tidal range of less than one meter (Hayes and Kana 1976:I:96; Science Applications 1981:I:29). The magnitude of the tidal range is a salient feature of the coast, affecting the size and shape of barrier islands and their associated inlets, marshes, and deltas. Barrier islands formed on a microtidal coast are topographically long and narrow and have open-water lagoons on their landward side. Barriers on microtidal coasts are often washed over by waves during severe storms, rarely support a maritime forest, and generally have no available fresh water. Such an environment could not support human habitation for long periods of time, although it could be attractive for short-term use. Moreover, it is likely that archeological sites would be destroyed in such an endlessly changing environment (Haag 1956; Thompson and Gardner 1979).

In the Embayed section are the Pea Island, Swanquarter, and Cedar Island refuges (Figure 2). The Pea Island Refuge, part of the Outer Banks, is now a northern extension of Hatteras Island, although as recently as the last century Pea Island was separated from Hatteras by a tidal inlet. On the Atlantic side, the refuge has an exposed, ocean-front shore. On the west, or sound-side of the island, is a tidal marsh. Pamlico and Albemarle sounds, the embayments behind the Outer

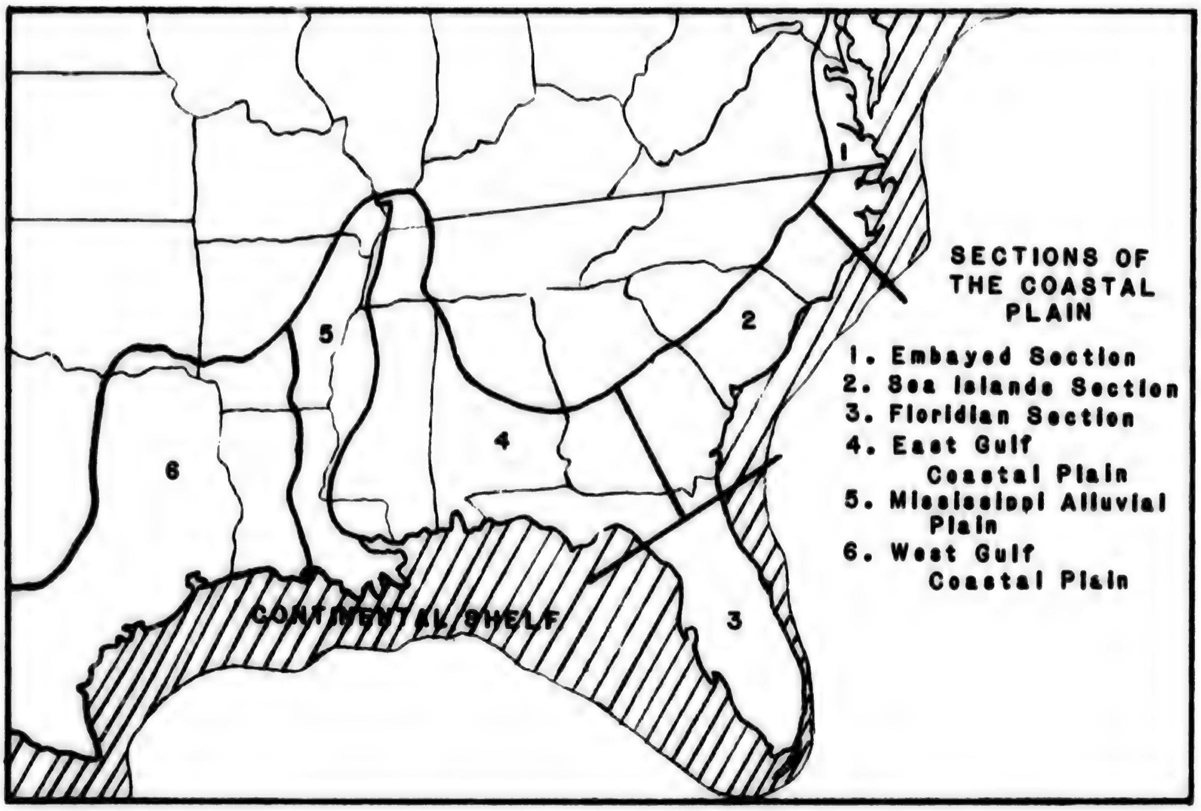
SECTIONS OF THE COASTAL PLAIN
1. Embayed Section
2. Sea Islands Section
3. Floridian Section
4. East Gulf Coastal Plain
5. Mississippi Alluvial Plain
6. West Gulf Coastal Plain
CONTINENTAL SHELF
1
2
3
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Figure 1. The southeastern United States, showing the Coastal Plain and Continental Shelf.

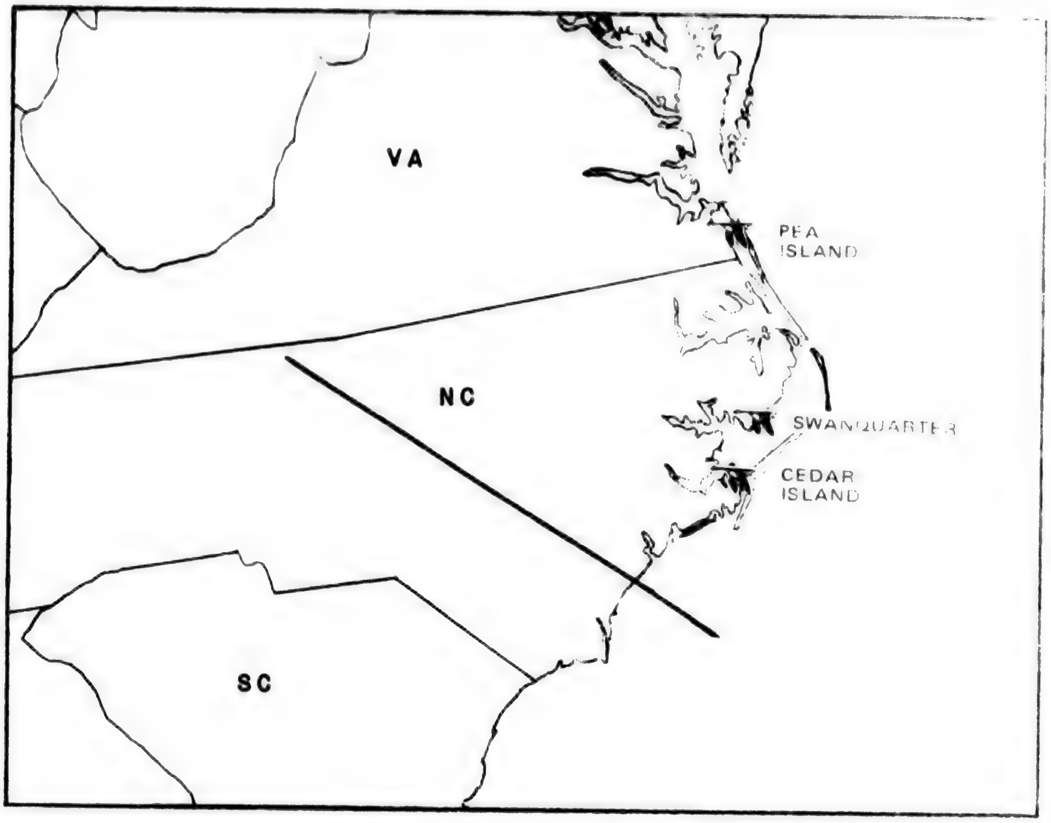

Figure 2. The Embayed section of the Coastal Plain, showing locations of the National Wildlife Refuges.

Banks, are the largest on the Atlantic coast. They are also among the most shallow, causing the estuaries to be strongly affected by wind tides (U.S. Army Corps of Engineers 1971). On the mainland south of Pamlico Sound is the Cedar Island Refuge; on the north side is Swanquarter Refuge.

The next section of the Coastal Plain is the Sea Islands section of the South Carolina-Georgia coast, with the Cape Romain, Pinckney Island, Savannah, Tybee, Wassaw, Harris Neck, Blackbeard Island, and Wolf Island refuges (Figure 3). In contrast to the microtidal coasts to the north and south, the Sea Islands are mesotidal. Tides affecting this part of the coast are more than twice the height of those further north and south, ranging from 4 to 8 feet (Fenneman 1938:44).

In the Sea Islands, the barrier chain is segmented into many small islands or "necks," composed of either Pleistocene or Holocene sediments. The larger islands rise 15 or 20 feet above tide, and frequently support maritime forests, freshwater ponds, and lakes (Fenneman 1938:44). On the landward side of the islands are broad networks of salt marshes, tidal flats and meandering creeks. Small hammocks represent areas in the marsh where older Pleistocene soils rise above the more recently deposited silts and clays. Even though these hammocks may rise only a few feet above the surrounding marsh, the slight change in elevation and soil types result in significant changes in the flora and fauna (Michie 1980:4).

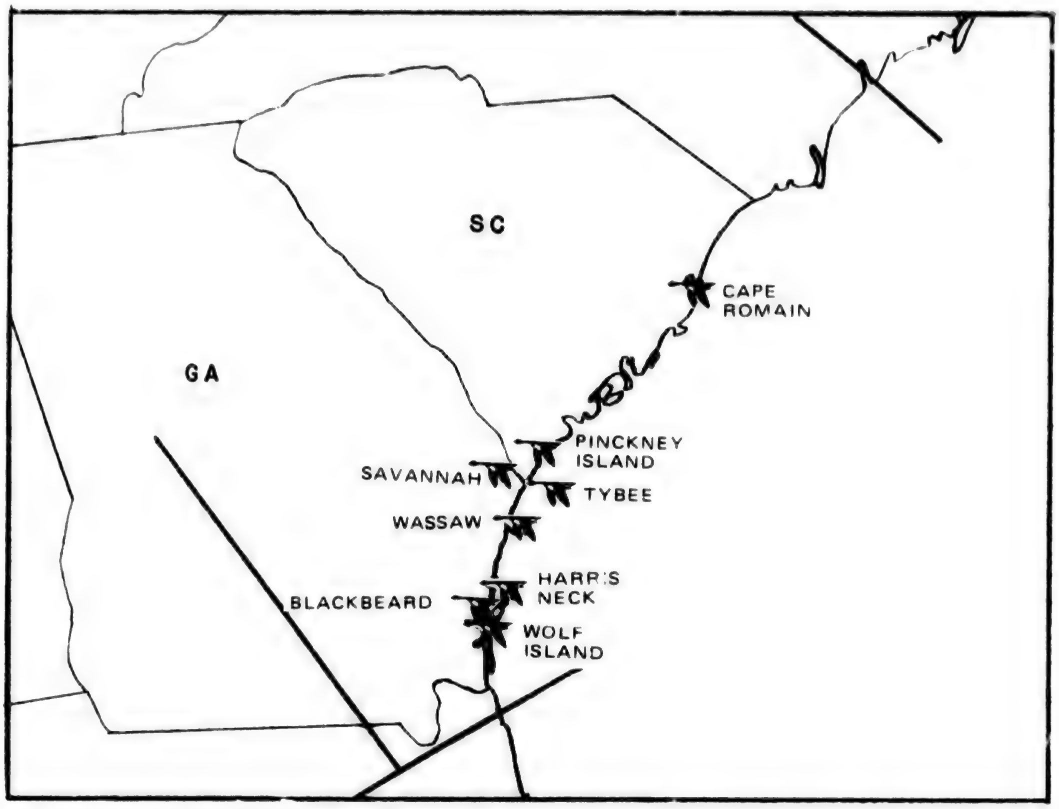

Figure 3. The Sea Islands section of the Coastal Plain, showing locations of the National Wildlife Refuges.

Salt water floods the lower marshes of the Sea Islands section daily or twice daily, damming the streams and causing them to overflow upstream (Fenneman 1938:45). This natural flooding, modified by artificial impoundments, became important economically in the 1700s and 1800s when the area led rice production in the United States (Fenneman 1938:44-45). The Fish and Wildlife Service has since adapted many of the old rice fields as impoundment areas for migratory fowl.

Cape Romain Refuge is the northernmost of the Sea Island refuges, occupying a 25-mile section of the coast bordering Bull Bay. Most of the refuge is estuarine marsh and is covered at high tide, although there is some dry ground on the mainland and on the offshore islands. The seaward face of the refuge is highly changeable, and large areas are built up and washed away in a matter of years.

The Pinckney Island Refuge, located south of Port Royal Sound, South Carolina, occupies Pinckney Island and several small hammocks in the marsh. Pinckney Island is Pleistocene in origin, and falls within the Pamlico terrace.

Oysterbed Island, essentially a man-made spoil bank, lies at the mouth of the Savannah River. Approximately 75 percent of the island is covered with redeposited sand from U.S. Army Corps of Engineers' dredging activites. The island, roughly 100 acres including the surrounding marsh, forms the Tybee Island Refuge.

Twenty miles inland from the mouth of the Savannah River is the Savannah Refuge. It is an area predominantly of freshwater tidal marsh underlain by clayey sediments dating to the Late Pleistocene. In the late eighteenth and nineteenth centuries the land was greatly altered when it was diked for rice cultivation.

Wassaw Island Refuge occupies Wassaw Island and an additional 10,000 acres of salt marsh. All high ground in the refuge has been formed over the last 3,000 to 4,000 years, and only the extreme western portion of Wassaw Island is older than 700 years (DePratter 1977).

Harris Neck Refuge, located on the northern end of an interior island, has both Pleistocene and Holocene soils. A small refuge, approximately one-half is salt marsh. The remainder is either freshwater marsh, pasture, or wooded upland.

South of Harris Neck is the Blackbeard Island Refuge. Blackbeard Island is a Holocene formation, and is dominated by dune ridges covered in dense vegetation (DePratter 1977). At a distance of 18 miles from the mainland, Blackbeard's remoteness has limited and influenced the extent of human usage (Marrinan 1979).

Wolf Island and its associated salt marsh, together with two small islands, comprise the Wolf Island Refuge. The low dunes adjacent to the beach have sea oats and sandburs, and myrtle bushes and cedars are on the higher ground. The remaining 75 percent of the refuge is characterized by salt marsh vegetation.

Below the mesotidal Sea Islands section lies the microtidal Floridian section, or Peninsular Arch, of the Coastal Plain (Figure 4). The barrier beach system that runs the length of the Atlantic coast extends into Florida with only a few changes. The Florida east coast barriers are generally long and narrow, and the estuaries behind them are small. The extensive marshes common to the north are largely replaced by open-water lagoons.

The refuges on the Florida east coast are Merritt Island, Pelican Island, and Hobe Sound. Merritt Island Refuge is in a geologically complex coastal area of beach ridges, cuspate forelands, barrier islands, and lagoons. Farther south is the Pelican Island Refuge, located on a series of small islands and mangrove swamps along the Indian River lagoon.

South of Indian River is the Atlantic Coastal Ridge, an area of old dunes and beach ridges alternating with swales. One tract of the Hobe Sound Refuge is located on the Ridge, with a separate tract on Jupiter Island.

Geologically distinct from the barrier islands that face the Atlantic, the Florida Keys are composed of two distinct lithologic units (Fenneman 1938:64-65). The Upper Keys are composed of Key Largo Limestone, a fossilized Pleistocene coral reef which lithified during the last interglacial (ca. 100,000 B.P.). The coral limestone of the islands generally rises less than 10 feet above sea level, although

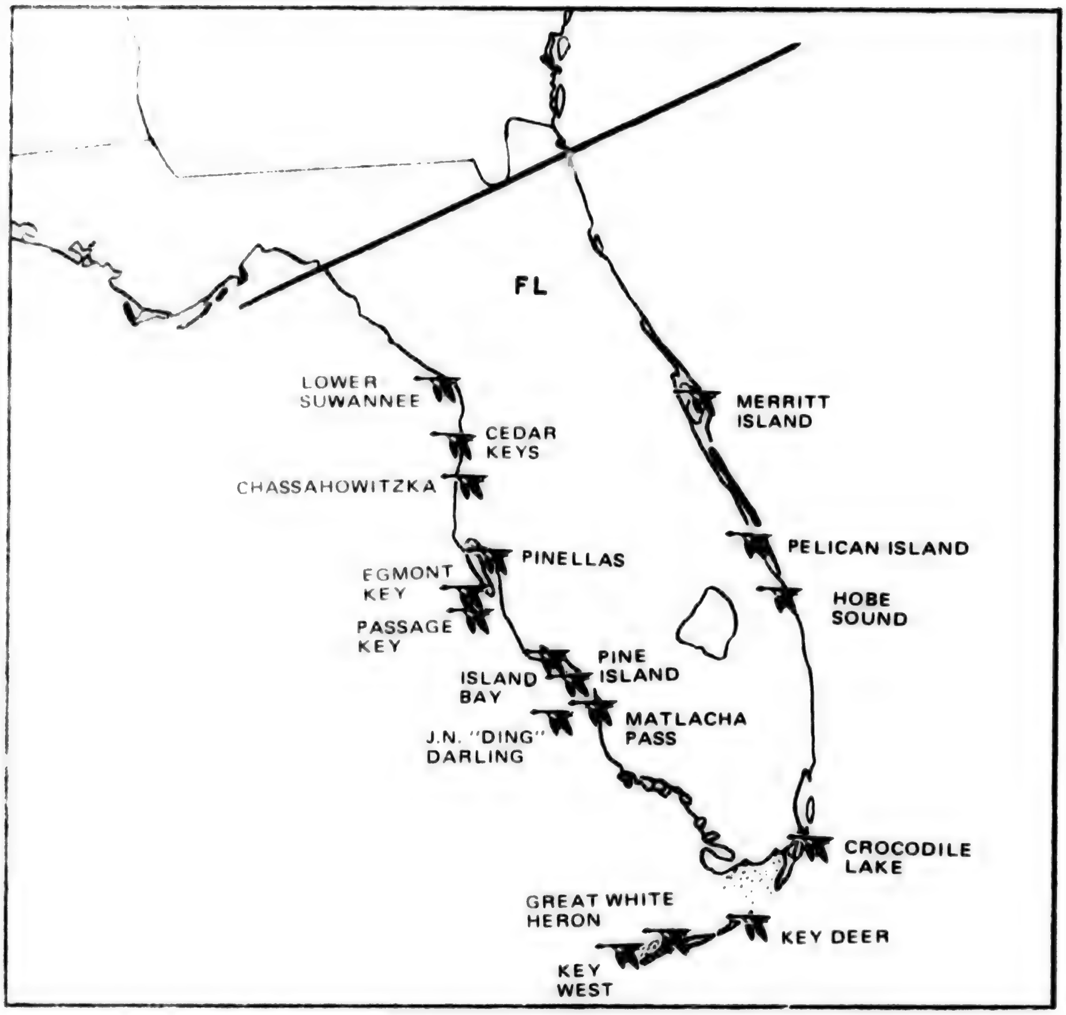

Figure 4. The Floridian section of the Coastal Plain, showing locations of the National Wildlife Refuges.

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beach ridges or blown sand may be piled up a few feet higher. Lake Crocodile Refuge lies on the western half of Key Largo, one of the largest and most northerly of the Upper Keys.

The Lower Keys, which resemble the Upper Keys topographically, are composed of Miami Oolite, a lithified limestone transformed from coral reef (Fenneman 1938). The National Key Deer, Great White Heron, and Key West refuges together account for much of the uninhabited area of the Lower Keys. Although the refuges include some acreage on the larger keys, most of the tracts are submerged (Griffin et al. 1979:4). Many of the smaller islands that once had mangrove vegetation have been completely burned off or timbered. Bedrock is occasionally exposed on the islands' surfaces probably due to storm tides or hurricane scouring.

On the gulf coast, southern Florida has a complex network of tidal creeks and scattered mangrove swamps (U.S. Army Corps of Engineers 1971; Milanich and Fairbanks 1980). Northward along the gulf is a series of barrier islands running sub-parallel to the coast, separated from the mainland by shallow tidal lagoons (U.S. Army Corps of Engineers 1971). The southernmost island in the chain is Sanibel, formed as a southeastward prograding lobe from Captiva Island. The northern half of Sanibel is the J. N. "Ding" Darling Refuge.

North of "Ding" Darling are the Pine Island and Matlacha Pass refuges, composed of small islands in Pine Island Sound and Matlacha Pass. On the mainland north of Charlotte Harbor is the Island Bay Refuge.

North of the barrier chain are the Passage Key, Pinellas, and Egmont Key refuges. Passage Key, a small barrier island with a geological history of constant modification, is now little more than a sandbar. The Pinellas Refuge consists of several small, mangrove-covered islands in Tampa Bay. Egmont Key, at the mouth of the Tampa Bay, is an island of low elevation, slightly less than 2 miles long. The soil on Egmont is primarily sand mixed with shell, and there are no swamps, marshes, or other forms of surface water.

North of Tampa Bay much of the shore is muddy, with vegetation extending down to the water's edge (Fenneman 1938:50). The lower coastal terraces in this area are underlain by limestone at shallow depths, and limestone outcrops and solution sinkholes are numerous (Coastal Environments 1977:28). On this section of the Florida coast are the Cedar Keys, Chassahowitzka, and Lower Suwannee refuges. The Cedar Keys Refuge encompasses four offshore islands. Geologically, the islands are sand dunes that were partially drowned when the sea level rose 3,000 to 4,000 years ago (Coastal Environments 1977:130-131). The Chassahowitzka Refuge encompasses a large area of brackish and salt marsh, mangrove-edged bays, and hardwood swamp interspersed with low sand and limestone ridges.

The Lower Suwannee Refuge is part of the delta system of the Suwannee River. Its topography is similar to that of Chassahowitzka and Cedar Keys, but it is distinguished by sand ridges back from the present coastline and by a lack of surface limestone (Dorian and Stoutamire 1981).

The northwestern coast of Florida, together with the coasts of Alabama and Mississippi, comprise the East Gulf Coastal Plain (Fenneman 1938) (Figure 5). The St. Marks Refuge stretches along Apalachee Bay in northwestern Florida. The shore in this area is dominated by large expanses of salt marsh. Inland, the area is a karst plain.

Immediately west of the Apalachicola River is the St. Vincent Refuge. Composed of Holocene barrier island sands, St. Vincent Island exhibits a number of well-developed beach ridge sets. The gulf and bay beaches of St. Vincent contrast one another in wave energy and available resources. The south is exposed directly to the gulf waves and has a harsh beach environment, while the protected bay side has a mature hammock vegetation.

The Bon Secour Refuge is on a barrier spit adjoining the mainland southeast of Mobile Bay, Alabama, with additional acreage on Little Dauphin Island and on the mainland east of the bay.

In Mississippi, the East Gulf Coastal Plain extends inland for about 40 kilometers, and is commonly called the coastal flatwoods. In this region, the Mississsippi Sandhill Crane Refuge contains acreage in tidal marsh, alluvial swamp, and pine forests. The marsh has been unsuitable for human settlement since it was formed when the sea level stabilized roughly 4000 B.P., although sites pre-dating that time may be buried under the later deposits (Swanson et al. 1979).

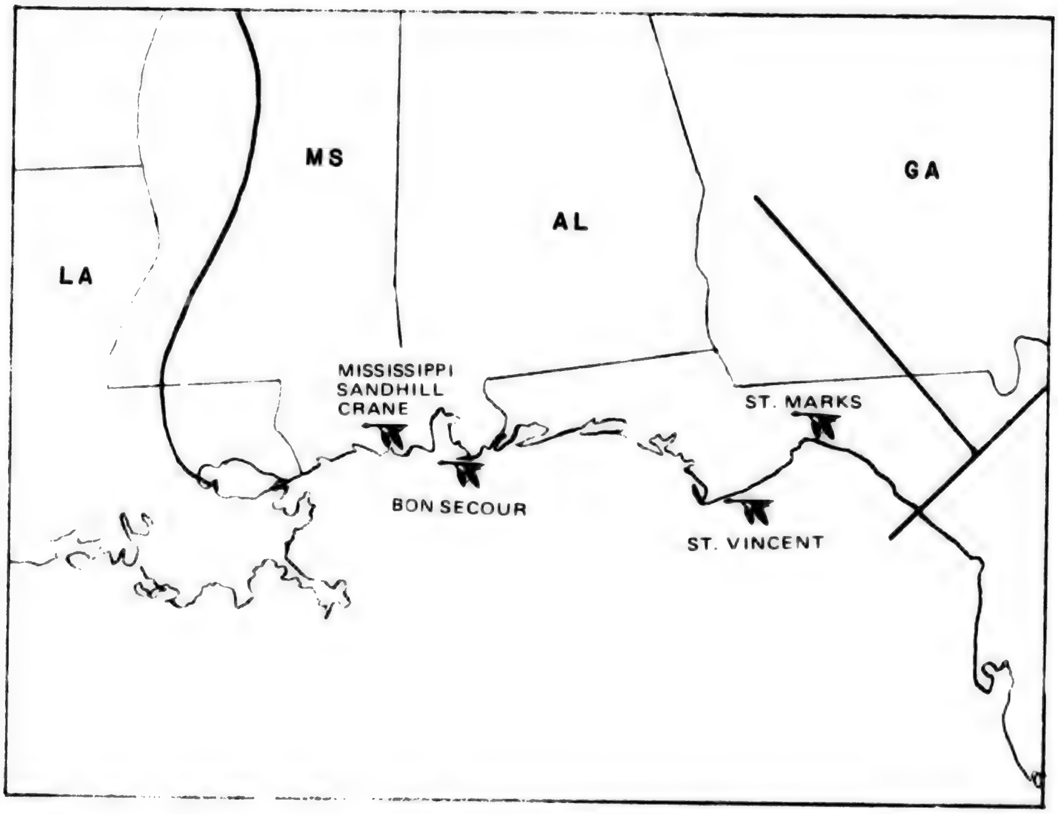

Figure 5. The East Gulf Coastal Plain, showing locations of the National Wildlife Refuges.

The next sections of the Coastal Plain are the Mississippi Alluvial Plain and the West Gulf Coastal Plain (Figure 6). The Mississippi Alluvial Plain includes the delta of the Mississippi River and its bottomlands (Fenneman 1938:83), and contains two refuges, Delta and Breton.

The Breton Refuge occupies Breton Island and parts of the Chandeleur Island chain. Breton Island was once part of the St. Bernard subdelta, which is now largely subsided into Chandeleur Sound. The delta was active ca. 2,800 to 4,700 years ago (Saucier 1974), when it would have been available for human occupation. Prehistoric sites for the island were reported in the 1950s, although they have since eroded into the Sound (DeBlieux 1982b).

The Delta Refuge is situated on the most recent part of the Balize or Birdfoot subdelta, which is the most recent of the Mississippi delta lobes. The lands on which Delta Refuge is now located did not exist until after 1838, and thus were not available for human occupation until historic times (Jackson 1979).

Further west is the Shell Keys Refuge, which consists of 8 acres of shell islands located several miles out in the Gulf. The keys are the emerged portion of a much larger shell reef. The archeological potential of the refuge is minimal.

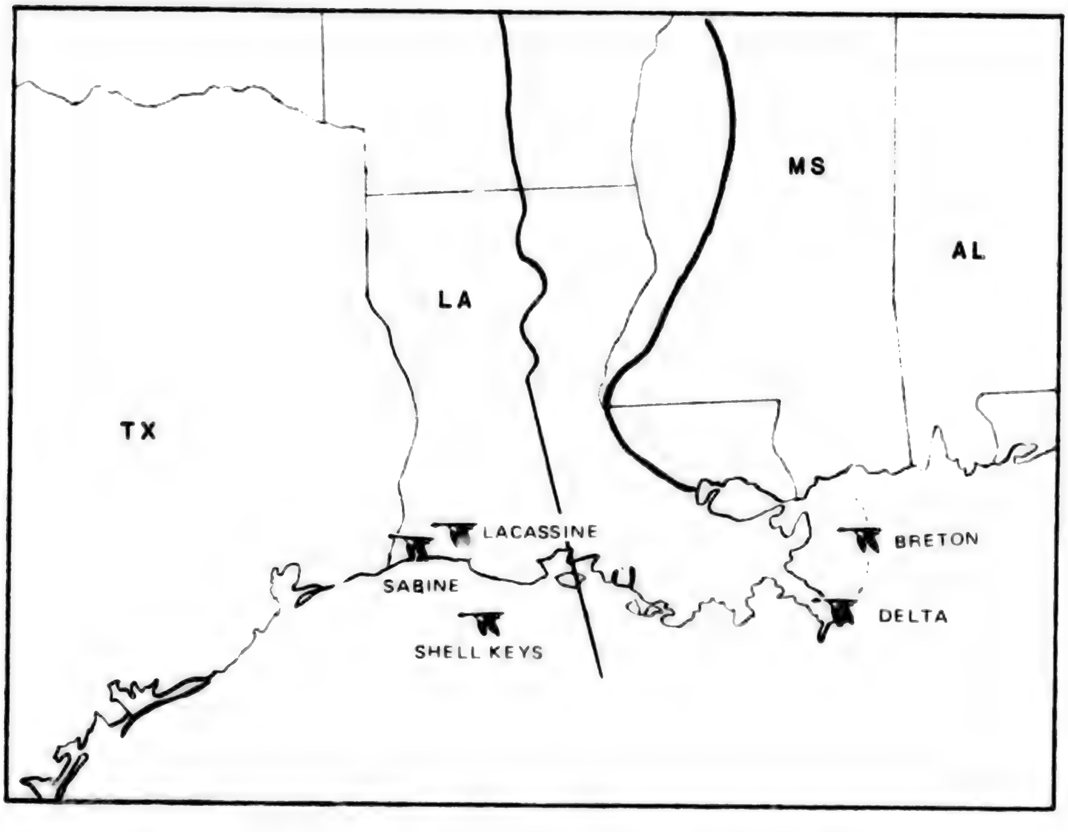

Figure 6. The Mississippi Alluvial Plain and West Gulf Coastal Plain, showing locations of the National Wildlife Refuges.

The coastal mainland of southwestern Louisiana is known as the Chenier or Marginal Deltaic Plain (Neuman 1977; Gagliano et al. 1975). The Chenier Plain, a Late Holocene formation, is the result of recent alluvium deposited by littoral currents flowing westward from the Mississippi River. In this section are the Sabine and Lacassine refuges. Within Sabine Refuge the predominant landscape is salt marsh, while in Lacassine Refuge freshwater marsh predominates. In addition to erosion, land subsidence is an important modifying process affecting this area (Saucier 1974).

# CHAPTER III

## COASTAL GEOMORPHOLOGY

The origins of coastal landforms strongly influenced prehistoric settlement along the coast. At the time of man's arrival in southeastern North America, approximately 11,000 years ago, the shoreline was many miles out on the Continental Shelf. Approximately 3,000 to 4,000 years ago, the sea level stabilized somewhat, reaching a position close to its present one. Relative changes since that time, postulated for many parts of the coast, affected not only the position of the shoreline but soil formation and resource availability on the Coastal Plain, and thus settlement and subsistence patterns of aboriginal populations (Michie 1980; Brooks and Scurry 1978).

For the following chapter, the discussion of coastal geomorphology in the Quaternary period is divided into three sections. The section on the Pleistocene is concerned primarily with the fluctuations in the sea level that were critical in the formation of the coastal terraces. The section on the Early and Middle Holocene discusses various theories of barrier island formation and the formation and deterioration of deltas. The final section on the Late Holocene deals with hypothesized fluctuations in sea level during the last 5,000 years, and the possible consequences of such oscillations on the present coastal archeological record.

### The Pleistocene (ca. 3,000,000-10,000 B.P.)

During the Pleistocene, sea level fluctuations occurred on the order of several hundred meters. These changes in the level of the sea resulted in the formation of the coastal terraces that now run more or less parallel along the southeastern coast, and affected the size and shape of the Coastal Plain that was available to the early aboriginal populations. The causes of the sea level changes were both eustatic and isostatic in nature.

Eustatic changes, defined as world-wide changes in sea level, are most commonly caused by a change in the volume of ocean water. In the Pleistocene, eustatic sea level movements were directly related to climatic changes that caused alternating episodes of glacial growth and decay. As glaciers grew, water was removed from the oceans and locked up in ice sheets, causing sea level to drop. When the climate warmed, glacial caps melted, returning water to the oceans and causing sea level to rise (Fairbridge 1960,1974; Bird 1965). Changes caused by the addition or subtraction of water from the oceans in this manner are termed glacio-eustatic, and were the major type of sea level change. Techno-eustatic movements, resulting from tectonic activity that alters the shape of the ocean basins, were secondary factors of change.

Isostasy (from the Greek, "equal standing") was a secondary contributor to sea level change in the Pleistocene (Bloom 1967; Fairbridge 1960). Isostasy is the equilibrium which the earth's crust maintains when heavy loads are placed on its surface (Gilluly et al. 1968:169; Bird 1965:24). In glaciated regions, the weight of the glaciers causes a crustal depression, followed by a gradual uplift of the land when the glaciers melt (Bird 1965). In other areas, such as the Mississippi delta, isostatic effects may result from heavy sediment loads placed on the earth's crust. Due to the nature of isostatic changes, some sections of a coast show a large amount of downwarp while others show no change or even uplift (Bloom 1967). This makes estimations of the true eustatic component of sea level change problematic, since regional changes due to isostasy must be accounted for (Blackwelder et al. 1979; Jelgersma 1966; Fairbridge 1960).

The coastal terraces that now line the coast had their origin in sea level fluctuations, but the actual mechanisms of formation are debated. It was long believed that the terraces were cut-and-fill formations formed under water and exposed when the sea level dropped (Cooke 1931). According to this interpretation, the terraces were shaped by alternating sequences of beach erosion by storm waves ("cut"), and deposition in calm weather ("fill") (Bird 1965:xvi). In contrast, Hoyt and Hails (1967) suggest that Pleistocene terraces are filled estuaries or abandoned lagoon-salt marshes.

Following the formation of the most recent terrace, approximately 25,000 B.P., the sea level began to drop. By about 19,000 B.P. (Blackwelder et al. 1979) or ca. 16,000 B.P. (Milliman and Emery 1968), the sea level reached a low stand where it stayed for a short while before beginning its rapid rise to the present level (Hoyt and Hails 1967; Fairbridge 1960). The depth of the low stand is disputed, but is estimated between ca. -130 meters (Milliman and Emery 1968) and ca. -60 meters (Blackwelder et al. 1979; Science Applications 1981:IV:14).

At the time of the lower sea, more of the Continental Shelf was exposed above sea level as fertile Coastal Plain and was thus available to early aboriginal populations. The horizontal exposure of the shelf varied according to its slope, but for most of the Southeast a vertical drop in sea level on the magnitude of 100 meters would have resulted in many kilometers of land being exposed (Figure 7). Now underwater, this exposed land would have been the locus of coastal adaptations of Paleoindian and Early Archaic peoples, if such adaptations existed. Our thinking about early populations, in terms of group size, distribution, and resource utilization, may be radically altered when the site potential of underwater areas is realized (Ruppe 1980, 1982; Emery and Edwards 1966). Recent studies on the archeological potential of the Continental Shelf (e.g., Coastal Environments 1977; Science Applications 1981), as well as reports on investigations at drowned terrestrial sites (e.g., Ruppe 1982; Goodyear et al. 1980) support the proposition of intensive occupation of once-exposed portions of the shelf.

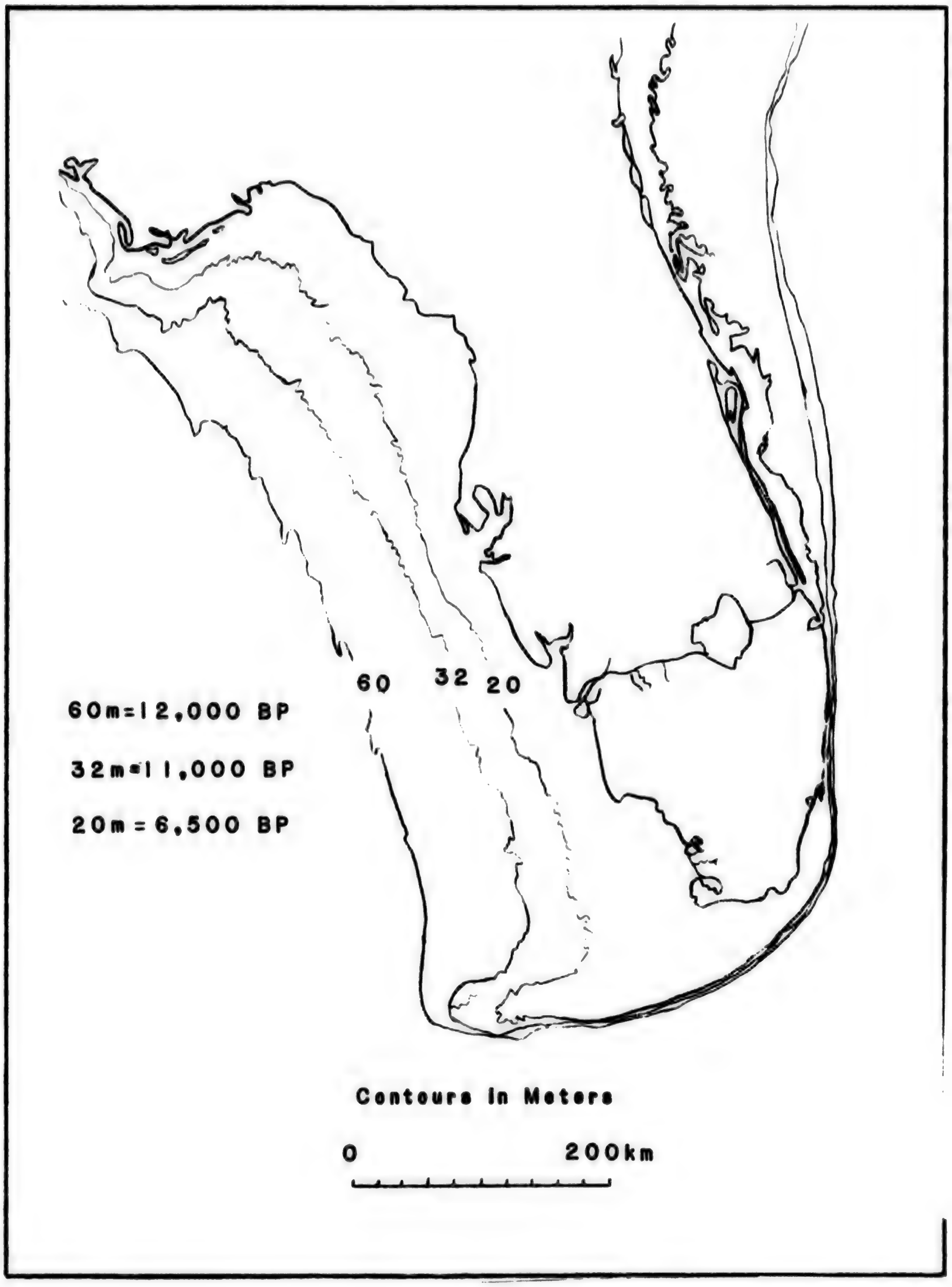

Figure 7. Contours of the Florida peninsula, showing exposure of land at 12,000, 11,000, and 6,500 B.P. (After Ballard and Ucuphi 1970).

The Early and Middle Holocene (ca. 10,000-5000 B.P.)

Subsequent to the Late Wisconsin low stand (ca. 17,000 B.P.), the sea level rose rapidly during the Holocene transgression (Milliman and Emery 1968). During the transgression, coastal configurations in the Southeast were altered drastically as the marine environment encroached on former Coastal Plains. By approximately 3,000 to 4,000 years ago the sea level more or less stabilized, reaching near its present height (Fairbridge 1960, 1974; Milliman and Emery 1968). Concomitant with the relative stabilization of the sea was the formation of the barrier islands that fringe the present coastline of the Southeast.

Two mechanisms of barrier island formation are hypothesized. The drowned beach ridge theory maintains that barrier dunes were formed during low sea level stands, then were partially submerged as the sea level rose (Figure 8) (Hoyt 1967). The area landward of the dunes was flooded as the water rose, becoming a salt marsh (Hoyt 1967; Johnson et al. 1974:68). Continued sea level rise resulted in the landward movement of barrier islands, as is evidenced by the inundation and burial of former sound-side archeological sites by washover and dune deposits (Godfrey and Godfrey 1976; cf. Leatherman 1983). An exception to landward migration is in areas where local sediment supply from rivers exceeds the sea level rise and net movement of the shoreline is seaward. This latter situation, that of a prograding barrier, is evident in the study area south of the Savannah River on Blackbeard and Wassaw islands.

The spit theory of barrier island formation suggests that barrier islands began as spits forming in a downdrift direction from eroding headlands. During storms, inlets were driven through the spits at narrow places, creating barrier islands (Figure 9) On some islands, marsh deposits progressing in age from one end of the barrier to the other, with the youngest material behind the downdrift end, provide evidence of spit formation (Redfield 1965). However, as a mechanism for barrier island formation, spit building is limited to small segments of the coast where sediment supply is abundant, and is secondary to the drowned beach ridge mechanism for most of the southeastern coast (Hoyt and Hails 1967). Archeologically, the pattern of initial site occupation differs from spit formed islands to drowned dune islands, and the erosion patterns affecting site preservation differ as well (Coastal Environments 1977).

Delta formation and deterioration, particularly in the Mississippi Alluvial Plain and the West Gulf Coastal Plain, was also operative in the Southeast during the Holocene. Deltas, alluvial deposits that form at the mouth of a river, progress through cycles of advance and retreat in four distinct phases (Frazier 1967). During the initial progradational phase, the river releases sediment into a body of standing water, and heavier sediments are deposited near the river mouth while finer sediments spread outward into the basin. Gradually silty sands and clays form bars in front of the stream or in the middle of the channel, causing the channel to bifurcate. In the second phase, levees are created along the channel, and a relatively stable stage is reached in which marsh vegetation flourishes and organic deposits develop.

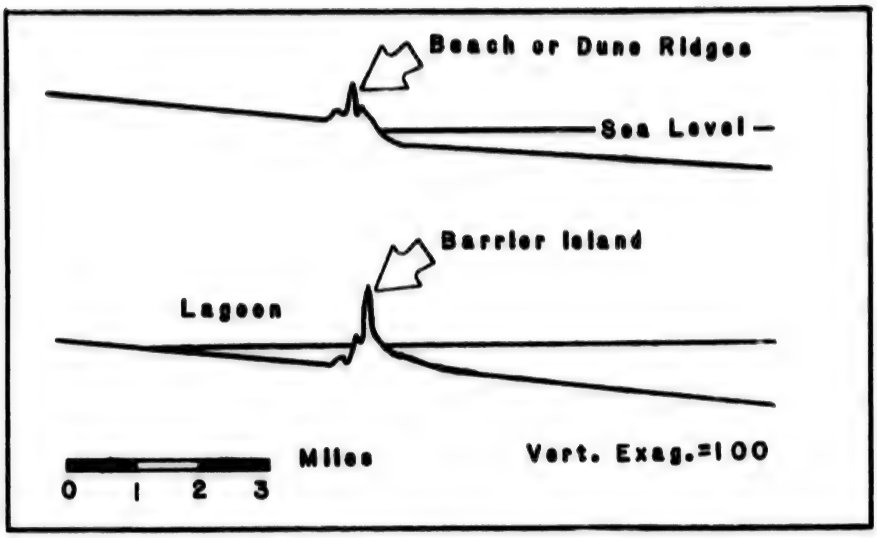

Figure 8. Drowned beach ridge theory of barrier island formation. Rising sea level isolates a dune ridge and floods mainland behind, creating a lagoon. (From Hoyt 1967)

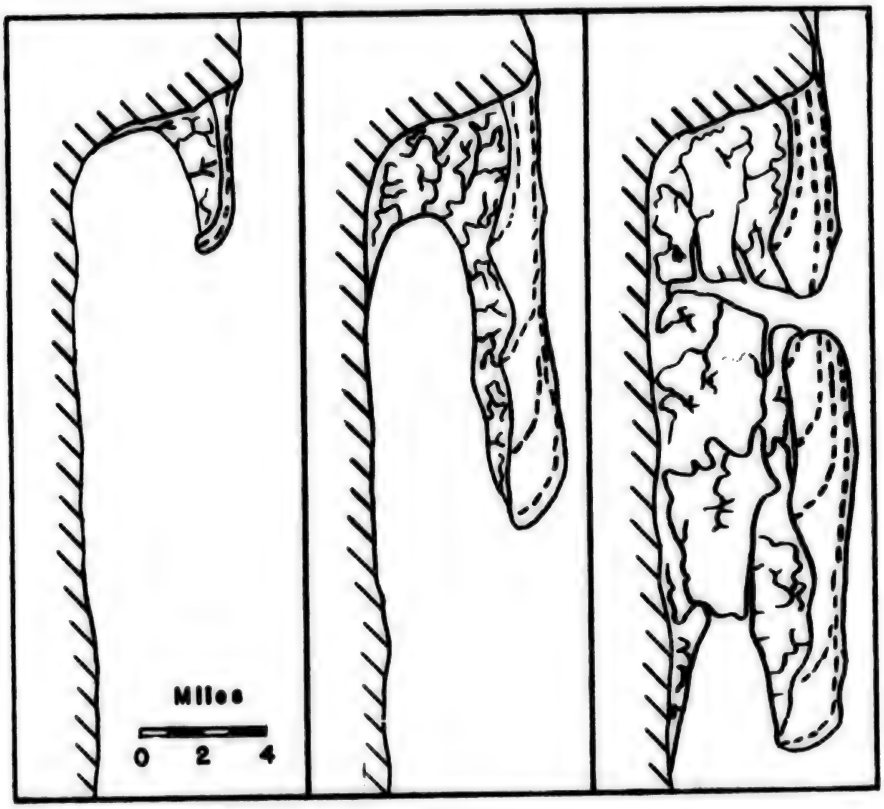

Figure 9. Spit theory of barrier island formation. Spit develops in direction of longshore sediment drift, then breaks to form an island. (From Hoyt 1967)

The third phase is abandonment or deterioration. When sediment has built up to the point that the stream gradient is very low, gravity demands that the stream shift course to take advantage of a steeper slope. The weight of the deposited sediments in the abandoned delta causes the land to settle or subside, and as land is lost the interface between land and water increases and biological productivity rises. Although initial human occupation is often associated with the early stages of delta development, it is during the stage of deterioration, when biological productivity is at its highest, that utilization of delta areas by hunting-and-gathering people was usually greatest (Coastal Environments 1977:181).

The final phase is the continued subsidence of the delta, which eventually results in a sufficiently steep gradient to cause the stream to reoccupy its former stream course.

Associated with the Mississippi delta formations are the deltaic plains which comprise the coastal lowlands of southern Louisiana (Saucier 1974:12-15). The Inactive Deltaic Plain consists of large, near-sea level tracts of marsh, swamps, lakes and bays, interspersed with remnant levees (Neuman 1977). West of the Deltaic Plain is the Marginal Deltaic Plain, commonly called the Chenier Plain. The Chenier Plain also consists of low marshlands and swamps, but is differentiated by the presence of relict shorelines called cheniers.

Cheniers are long, narrow ridges, parallel to the coast, which rise 5 to 10 feet in height, vary in width from tens of feet to 150 feet, and extend for miles (Saucier 1974). The cheniers were formed by the westward transport of sediments from the Mississippi River at times when the river mouth was west of its present position. When the river shifted eastward, sedimentation ceased and the coast retreated, leaving stranded beach ridges composed of sand and shell (Coastal Environments 1977). In prehistoric times these former beach ridges provided high ground for habitation in an otherwise low marshy area, and initial human occupation of a chenier is closely related to the time when it was an active Gulf beach (Gagliano et al. 1975).

## The Late Holocene (ca. 5000 B.P.-present)

The Late Holocene dates to approximately 4,000 to 5,000 years ago, when the world-wide rise in sea level slowed considerably and essentially modern climatic and environmental conditions made their appearance. It has been hypothesized that sea level during the Late Holocene has either remained constant, risen at a very gradual rate, or fluctuated slightly (see Shepard 1964; Missimer 1980). Complications in interpretation of data, caused by regional tectonic movements, local changes in tides and coastal configurations, internal dynamics of ocean circulation, or possible geodetic ("storminess") effects on sea level, have precluded a consensus among marine geologists concerning eustatic sea levels during the past 4,000 or 5,000 years. However, evidence for what may be minor oscillations of the sea, on the order of ± 3 meters, is recorded for many areas of the southeastern coast (Stapor and Tanner 1977; Missimer 1980; Holmes and Trickey 1974; Brooks et al. 1979;

Colquhoun et al. 1980). Though perhaps negligible with respect to large-scale geological processes, the impacts of a several meter change in sea level for local environments, and for prehistoric populations, would have been measurable (Fairbridge 1960; Ruppe 1980,1982; Michie 1980; Brooks and Scurry 1978; Griffin 1974). Such changes would be reflected in the archeological record by shifts in cultural patterns such as settlement and subsistence. The study of these changes may give insights into cultural adaptations to short-term environmental changes.

Research on sea level often involves the study of geomorphic indicators such as corals, diatoms, shallow water molluscs, and oolite deposits. The present position of indicators above or below sea level is compared with their position at the time of their active life, when they lived in a narrow, intertidal zone. Similarly, the elevation of an archeological site above or below present day sea level, or its burial underneath alternating layers of freshwater deposits and salt marsh clays, is often taken as an indication of sea level change. Habitation sites, which would have been occupied when their ground level was above water, are often used as a datum point or terminus post quem for inundation by a rising sea (Ruppe 1980; Lepionka 1980; Holmes and Trickey 1974). However, climatic conditions, unrelated to sea level changes, may mimic the stratigraphic sequence produced by a rise in sea level (Jelgersma 1966; Smith et al. 1981; Holmes and Trickey 1974). Episodes of drought can lead to incursions of salt water far up into an estuary, while periods of excessive precipitation can cause incursions of fresh water into an area or lead to floods bringing down layers of alluvial sediment.

In the Mobile Bay area of Alabama, near the Bon Secour Refuge, many archeological sites showing stratigraphic sequences of alternating marine clays and cultural deposits have been recorded (Holmes and Trickey 1974). The sites were apparently occupied, inundated by rising water levels, and reoccupied during times of lower water levels. Although climatic conditions may have resulted in this phenomenon, the researchers believe that the sequences are most likely related to changes in sea level. Similarly, at the St. Vincent Refuge in Florida, Stapor and Tanner (1977) concluded that during the past 4,000 years sea level had reversed (from rise to fall, and from fall to rise) four times, each time on the order of 1 to 3 meters. Part of their research resulting in this conclusion was based on archeological data (Stapor and Tanner 1977; see also Braley 1982b:5).

Using a different approach, Michie (1980), working in Port Royal Sound, South Carolina, showed that human populations occupied different parts of the estuary during different time periods, and hypothesized that these different locational patterns were related to changing elevations of the sea. The occurrence of Deptford ceramics in the seaward portion of the estuary may indicate lower sea level stands during the Early Woodland, while the westward location of Middle and Late Woodland sites may indicate a higher sea level stand during that interval. Michie suggests that the rising sea affected settlement in the estuary in a predictable way, and that these patterns can be used as a model for site location in other estuarine systems.

Site distribution on the inter-riverine areas on the Coastal Plain has also been used in an effort to indicate relative sea level positions. For the South Carolina Coastal Plain, Brooks, Colquhoun, Pardi, Newman, and Abbott (1979) hypothesized that during higher sea level stands, sites on the Coastal Plain would cluster in pockets of high, well-drained soils. During low stands, sites would be more widely dispersed across the land as the availablilty of well-drained land increased (cf. Smith et al. 1981:53-54).

Apart from their use in studying changes in sea level, archeological data may be used to determine rates of shoreline progradation. On the basis of archeological site distribution, DePratter (1977) showed that only the extreme western end of Wassaw Island, Georgia, is more than 675 years old, the east side being the result of rapid progradation characteristic of areas downdrift of a large sediment supply. This pattern of deposition suggests that prehistoric sites will be found only on the western section of Wassaw, and that they will date to late Prehistoric times (Pearson and Pearson 1978). Similar work on Blackbeard Island has shown that the entire island has been deposited within the last 1,500 years (DePratter 1977). Such information, important to the study of geology, has obvious practical implications for archeological research in coastal areas.

# CHAPTER IV

# COASTAL PREHISTORY

This summary of the prehistoric occupation of the coastal areas of the Southeast is organized around the four major cultural-historical periods for North America, the Paleoindian, Archaic, Woodland, and Mississippian periods. The discussion includes cultural groups who lived, year-round or seasonally, in a coastal environment where a substantial part of their subsistence and technological resources could be obtained from a marine or an estuarine source (after Stark and Voorhies 1978). These coastal cultures, with their generally abundant availability of aquatic resources and their geographical position at the seaward edge of the continent, show singular and distinctive means of adapting to their environment.

The cultural and economic patterns that prevailed along the United States' southeastern coast differ, but are not totally separate, from the classic cultural patterns associated with inland areas. This "separate-yet-part-of" status of coastal cultures as they relate to inland cultures is often expressed as "marginality," a term misleading if it suggests an inferior adaptation on the part of coastal peoples. In their work on prehistoric coastal adaptations in Middle America, Stark and Voorhies (1978) comment on the recurrent issue of marginality, suggesting that the notion is in part due to the past research emphasis on the uplands. This upland emphasis has resulted in a distorted view of the overall culture history, deemphasizing the role of coastal peoples. Their observation, intended for Mesoamerican studies, could well be extended to the southeastern United States.

Other historical and environmental vagaries have also contributed to the notion of coastal marginality. The first Amerindian cultures to come into contact with Europeans were the coastal cultures, and the early colonists settled in coastal areas, effectively erasing much of the archeological record. Changes in the shoreline due to the rising sea level, and the interplay of tides, currents, and winds, also produce an environment of accelerated change compared to interior regions, and threaten our confidence in the coastal archeological record (Stark and Voorhies 1978:285). However, "marginality," in and of itself, has no explanatory power for archeologists seeking to understand the "whys" and "wherefores" of prehistory. The reflection of geographical, climatic, and other environmental conditions is an axiom in American archeology (e.g., Willey and Phillips 1958), and coastal cultures should be viewed as unique reflections of their littoral settings (Larson 1980).

## The Paleoindian Period (?-9000 B.C.)

The Paleoindian period of the southeastern United States ranges from humankind's earliest occupation of the area to approximately 9000 B.C. Traditionally, our knowledge of the period has come from inland settings, with virtually nothing being known of possible Paleoindian coastal adaptations. Paleoindian cultures were presumably inland, nomadic hunting-gathering cultures whose basic social and political unit was the egalitarian band. Settlement on the Coastal Plain during the Paleoindian period, which at that time extended far out from the present coastline and was a rich, fertile, and environmentally diverse area (Carbone 1983), is indicated by temporary or seasonal campsites located near small drainages, often on high ridges above floodplains. Larger, more permanent base camps are also found, generally associated with major river drainages and stream systems (Michie 1980:63-64; Milanich and Fairbanks 1980:38). The availability of raw lithic materials, as well as nearness of potable water, were two major factors in Coastal Plain Paleoindian settlement (Science Applications 1981:II-26; Waller and Dunbar 1977).

Our lack of knowledge about possible Paleoindian coastal adaptations, and the refusal of many archeologists to entertain the possibility of a Paleoindian coastal adaptation, is attributable in part to the post-Pleistocene rise in sea level that would have obscured all traces of former coastal occupations (Ruppe 1982). Although Shepard (1964) and Emery and Edwards (1966) pointed out the potential for drowned archeological sites on the Continental Shelf, their comments went generally unheeded for a number of years (Ruppe 1982). Only recently, as our technology for studying underwater sites and our ability to use remote sensing to detect sites has increased, has the potential been taken seriously (Ruppe 1982; Gagliano et al. 1982; Coastal Environments 1977; Stickel 1981; Roberts 1981; King 1982; Patterson 1981; Fleming 1981; Science Applications 1981). This new awareness of the archeological potential of the shelf will likely result in the recognition that early prehistoric populations were larger than we tended to think, and it may lead to the recognition of previously unrecognized Paleoindian adaptations. As Marrinan (1975:110) and others (Patterson 1981) have pointed out, it is almost axiomatic in archeology that when one sets out to find something there is usually success, and the fact is we are just now beginning to look at the submerged Coastal Plains off the Atlantic and Gulf coastlines.

The question of when marine resources were first used in the diet of prehistoric hunter-gatherers is debated. Traditionally it has been assumed that hunter-gatherers did not intensively exploit marine resources until the post-Pleistocene period (Binford 1968). In the United States, it has been assumed that reliance on molluscs and other marine resources was an invention intimately related to increased sedentism and to the invention of ceramics during the Archaic period (Caldwell 1958:12-15).

Osborn (1977), in his study of the Peruvian coast, suggests that humans' initial use of marine resources could be due either to environmental changes, technological developments, or ideological changes, such as early human populations' increased awareness of their environment. Osborn posits that marine ecosystems are less productive than terrestrial ecosystems, and that the collection of marine foods of the intertidal area, particularly shellfish, is more labor intensive than the harvesting of terrestrial foods. Large quantities of shellfish must be collected before the protein equivalent of even an average size terrestrial animal is reached; for example, 83,422 mussels are required to provide the same amount of protein as an average whitetail deer (Osborn 1977:172). Osborn hypothesizes that only when human population densities were high and when stress was placed on existing food resources would human groups turn to less than optimal food resources such as shellfish, fish, and sea mammals. However, others (e.g., (Neitschumann 1973:174-175) disagree with Osborn's generalization that marine resources are less attractive for subsistence than terrestrial fauna.

Turning to the southeastern United States coast, there is a general belief that marine resource exploitation did not begin until the stabilization of the sea ca. 4,000 years ago (e.g., Caldwell 1958; DePratter and Howard 1980), although exploitation of freshwater molluscs is known as early as the Early Archaic (Milanich and Fairbanks 1980:50; Cumbaa 1976). Along the Georgia coast, Crusoe and DePratter (1976) dismiss, on geological and ecological grounds, the idea that there was shellfish utilization before the Late Archaic. They reason that only after the sea level stabilized did the land behind the present barrier islands develop into salt marshes that would support large oyster beds, and that oyster beds would not have been located further out on the Continental Shelf during this time. Goggin (1952) indicated that no large populations lived on the Florida coast until the St. Johns period (ca. 500 B.C.) because the waters of the coastal lagoons were too fresh to support oysters. When the sea rose, salinity increased and shellfish flourished in the lagoons (cf. Cumbaa 1976). For New England, Dragoo (1976) and Braun (1974) support a similar interpretation, stating that the shift in stream gradients which accompanied the rise in sea level made stream waters more suited to shellfish. However, Marrinan (1975:109-110) finds it "inconceivable" that the sea level rise prior to ca. 2550 B.C. was so rapid that the conditions for growth of the extensive mollusc beds never occurred. Marrinan further notes that even if no oyster beds were present there would have been other exploitable marine resources.

It is possible that the late date for North American middens may be an artifact of the rising sea level rather than an indication that molluscs were not part of the diet prior to that time. While no shell middens are known for the North American coast before 2250 B.C., earlier shell middens are known for the Brazilian coast (Colquhoun et al. 1980:154). During the Holocene, sea level stands were higher along the South American coast, resulting in South American middens being elevated above present sea level rather than being submerged. More recently, research at the Klasies River Mouth site in South Africa, where preservation is excellent, has shown that marine resources, including shellfish, were utilized as part of the Middle Stone Age diet as early as 120,000 B.P. (Singer and Wymer 1982:155,207).

On the Florida west coast, Warren (1964), and Goodyear and Warren (1972), have studied submerged oyster shell deposits that may have been terrestrial middens at the time they were deposited. During dredging of the shell piles, Paleoindian and Early Archaic projectile points were collected, together with several Middle and Late Archaic points and small quantities of ceramics. If the oyster shell deposits are middens, they would represent the oldest known shell middens in the Northern Gulf area (Coastal Environments 1977). However, the association of Paleoindian period lithics with the shell midden material may simply be fortuitous, indicative only of a long-term occupation in which the late inhabitants alone harvested shellfish (Science Applications 1981:II:38).

In reviewing the question, the probability of past Paleoindian littoral adaptations is high, although as yet there is no definitive evidence for such adaptations. As a cautionary note, Snow (1974) warns that the age of shellfish utilization in an area must be determined on the basis of data from that area and cannot be presumed on the basis of extrapolation from another area. He also warns us not to be too easily swayed by the argument that a food resource, if available, must therefore have been utilized. He notes that there are both archeological and ethnological cases where the availability and "obvious" utility of a resource did not lead to its quick adoption. Moreover, he, like Osborn (1977), argues that the adoption of shellfish gathering, even if only on a small scale, would have entailed a significant readjustment of existing economic patterns.

The nature of Paleoindian sites in the present day coastal zone is such that, if present at all, they will be few in number and emphemeral in nature, having been altered considerably by the post-Pleistocene sea level rise. Typical of Paleoindian "sites" in the littoral zone are isolated finds of diagnostic artifacts--fluted projectile points, unifacially and bifacially flaked scrapers, and other specialized tools. The artifacts were in all probability deposited in an upland setting, since the barrier islands and their associated lagoons and marshes, which now separate many of the finds from the open gulf or ocean, were not formed at the time of the lithics' manufacture (Coastal Environments 1977:290; Loftfield 1976; Williams 1977:236-240). However, seaward of the coastal zone on what is now the Continental Shelf, drowned terrestrial sites from the Paleoindian period are present, even though their extent and degree of preservation are not known (Ruppe 1982; Science Applications 1981; Coastal Environments 1977).

### The Early and Middle Archaic (ca. 9000-2250 B.C.)

Following the Paleoindian period, and in some areas partially contemporaneous with it, came the Archaic period. The record for the coastal adaptations of the Early Archaic (ca. 9000-7000 B.C.) and the Middle Archaic (ca. 7000-2250 B.C.)--if such adaptations existed--would now be submerged on the Continental Shelf. In the broadest terms, however, the Early Archaic was a time of local populations readapting to changes in the environment brought about by the warming of the climate at the end of the Pleistocene. As the large Pleistocene mammals began to be replaced by essentially modern animals, Archaic populations were forced to search out a new range of food resources. Hunting activities shifted to smaller mammals, and reliance on plant and aquatic resources increased. The cultural uniformity of earlier traditions that existed over much of Eastern North America broke down and regional complexes began to develop (Dragoo 1976:11).

Little is known about settlement and subsistence in the Early and Middle Archaic. For the south Atlantic, current data suggests that occupation on the Outer Coastal Plain was apparently absent or relatively limited until the Late Archaic (Science Applications 1981:II-83). Data from South Carolina indicate that Archaic period sites on the Coastal Plain, when contrasted with subsequent Woodland period sites, are typically small, few in number, and show little archeological material, traits we would expect for a population with a small group size and high mobility (Brooks and Scurry 1978:44).

As with Paleoindian period occupations, intact Early and Middle Archaic sites in the coastal zone are rare. Most finds are either scattered or dispersed lithic assemblages or isolated surface finds, with little if any context (Michie 1980:64). However, submerged or partially submerged sites from the Early and Middle Archaic are known for much of the study area (Emery and Edwards 1966; Bullen 1969; Goodyear and Warren 1972; Goodyear et al. 1980). Studies of spoil from dredged underwater sites have revealed Early and Middle Archaic occupations, demonstrating the research potential of disturbed sites (Goodyear et al. 1980; Gagliano et al. 1975). Many refuges have dredging operations on their property, and the possibility of early sites turning up in dredge spoil should be anticipated.

### The Late Archaic (2250 B.C.-1500 B.C.)

The Late Archaic, a period which dates to the time of the relative stabilization of the sea, is marked by the general appearance of coastal-estuarine shell middens in the Southeast. During this time populations gained a fairly complete mastery of the materials in particular local environments (Griffin 1952), a fact reflected in the adaptive strategies identified for different zones in the Coastal Plain (e.g., a general foraging pattern for the mountainous province; a focus on anadromous fish for the Inner Coastal Plain; and an emphasis on shellfish in the Outer Coastal Plain) (Science Applications 1981:II:52). There was a marked increase in population, the establishment of long distance trade, increased complexity in social organization, and a greater degree of sedentism. Although the inventory of human skeletal material from this period remains relatively low, the beginnings of mortuary ceremonialism are evident (Willey 1966:268; Tesar 1980:43).

An important addition to Late Archaic technology along many parts of the southeastern coast was the inclusion of ceramics. The earliest ceramic complexes in North America are from the southeastern coast, with the earliest reported date being ca. 2,500 B.C. from the Groton Plantation site along the Savannah River (Stoltman 1966).

The introduction of ceramics along the southeastern coast is traditionally linked with sedentism and the harvesting of shellfish (Caldwell 1958:12-15). In re-examining the link between pottery and sedentism, Marrinan (1975:99-100) notes that an archeological site, such as a base camp, may give the appearance of sedentism, while the population occupying the camp may have had a highly mobile daily hunting-gathering round with a far from sedentary lifestyle. While it is traditionally argued that it is difficult to travel with ceramics, Marrinan notes that if most of the traveling was by water transport rather than by foot, the difficulty would not have existed. Although the use of the canoe is not documented for this time period along the Georgia coast, Bullen and Brooks (1967) have dated a canoe in Florida to 1000 B.C., and it is likely that canoes were also in use along the Georgia coast during this time (Marrinan 1975:107).

The nature of Late Archaic sites along the southeastern coast is radically different from the nature of archeological remains from preceding periods. Large deposits of shell are frequently found in the present-day shoreline along the ecotonal break between salt marsh and mainland. Late Archaic shell middens are also found submerged offshore (Goodyear et al. 1980); buried in marshes several meters beneath the present surface (Marrinan 1975); and on high bluffs along the shores of saltwater sounds (Loftfield 1976). The sites now on high bluffs were probably once on mounds or hills located away from the water's edge, and have since eroded to their present bluff position (Loftfield 1976:110).

Coastal shell middens from the Late Archaic are generally of two types: linear shell middens, and large ring-shaped or crescentric shell middens. Away from the swamps and rivers, small hunting and collecting camps, lacking shell, are sometimes found (DePratter and Howard 1980:11; Milanich and Fairbanks 1980:62). Linear middens generally extend along the coastline adjacent to the marsh, ocean, or gulf, or along levees of active or abandoned stream courses (Neuman 1977:18). They are formless refuse heaps composed primarily of mollusc shell, but include a cross-section of daily life in the form of bone, ash, pottery fragments, and other organic and inorganic debris (Gagliano et al. 1975:12). The linear middens from the Late Archaic indicate a broad range in the subsistence remains, showing aboriginal use of molluscs, mammals, birds, and reptiles. In contrast, the smaller, more numerous middens from the later Woodland period show little diversification in shellfish species and have only minimal amounts of fish and terrestrial remains (Michie 1980:71-72; Colquhoun et al. 1980:152).

Linear middens from the Late Archaic are found throughout most of the study area, although as of yet no Late Archaic middens are known for North Carolina (Science Applications 1981:II-55; Loftfield 1976). Middens from South Carolina and Florida sometimes show a preceramic occupation at their base, but preceramic occupations are apparently absent for middens along the Georgia coast (Smith et al. 1981).

Ring-shaped shell middens, also known as shell rings, differ from linear middens in both shape and content. These middens may measure up to 100 meters in diameter and up to 4 meters high (DePratter and Howard 1981; cf. Marrinan 1975:4). The rings are circular embankments of shell and mixed midden debris, including mollusc, vertebrate, and human cultural remains, with the interior of the rings often devoid of artifacts (Walthall 1980:78; Science Applications 1981:II-54; Williams 1977:246). The function of shell rings is disputed, with interpretations ranging from ceremonial centers to base camps (Marrinan 1975:4-9; Williams 1977:245-246). The known distribution of the ring-shaped middens in the Late Archaic is limited to the Sea Islands section of the Georgia-South Carolina coast (Marrinan 1975:4; Milanich and Fairbanks 1980:66-68; cf. Walthall 1980:78). A possible exception is the Joseph Reed Mound (8 Mt 13) located in the Hobe Sound Refuge in Martin County, Florida. The ring, half of which has been lost to erosion, has the appearance of a prehistoric shell ring, but it may be the remains of a nineteenth century dike built to protect a citrus grove. A testing program could determine its origin and evaluate its eligibility for the National Register.

Since so little is known about Late Archaic occupations of the coast, sites from the Late Archaic are likely to yield important, non-redundant data. Research at sites such as Shired Island West (8 Di 7), a stratified midden in the Lower Suwannee Refuge, which in earlier investigations has shown evidence of trade between peninsular Florida and northern Alabama, could yield important information about aboriginal lifeways during the Late Archaic.

### The Woodland Period (ca. 1500 B.C.-A.D. 950)

The Woodland period, once thought to be sharply distinguished from the Archaic by the abrupt introduction of agriculture, burial ceremonialism, and ceramics, is now seen as having a strong continuity and an overlap of traits with the Archaic (Dragoo 1976; Walthall 1980:77,104). This is not to say there were no changes: fiber-tempered pottery disappeared and was replaced by the widespread use of ceramics tempered by sand, grit, or limestone, and foreign materials and new ideas spread as trade increased. There were also significant changes in social organization and ceremonial life, and marked increases in population and sedentism (Griffin 1952; Walthall 1980:77). However, for much of the Southeast, and particularly in many coastal areas, the basic economy for the Woodland remained similar to that for the Late Archaic (Griffin 1952).

During the Woodland, regional variation increased as populations became more accustomed to their local environments, to the point that it is misleading to generalize for the entire southeastern coast. The rest of the chapter is therefore organized by regions, starting with the North Carolina coast, moving south to Florida, then west toward Louisiana.

In North Carolina, the Woodland period marked the first appearance of shell middens and ceramics (Haag 1956:129; Thompson and Gardner 1979). Early Woodland ceramic periods are poorly represented, with the majority of cultural remains along the North Carolina coast dating to later ceramic periods (Loftfield 1976:238; Phelps 1982:12-13). At some point in the Woodland period cultivated plants were added to the diet, even though the sandy soils of the North Carolina coast were better suited for hunting and gathering than for agriculture (Loftfield 1976:22).

Late Woodland sites along the upper reaches of the North Carolina coast are almost always located immediately adjacent to the water, suggesting that by the late prehistoric period coastal adaptations were highly refined (Loftfield 1976:239; Phelps 1981:47). However, the Late Woodland adaptation to marine-estuarine environments apparently diminishes as one goes south along the coast into South Carolina (Anthony and Drucker 1981:51). This shift in adaptive strategies may have its roots as far back as the Early Woodland, and is probably connected to the physiographic change from north to south, from a rich sound-estuary environment to a harsh beach strand environment (Anthony and Drucker 1981:51).

Along the southern South Carolina and Georgia coasts, Woodland period shell middens, and especially Middle Woodland middens, are well represented (Michie 1980; Drucker and Anthony 1980). The earliest phase of the Woodland period for this section of the coast is the Refuge phase, named after the type site in the Savannah Refuge (Williams 1977). During the Refuge phase, settlement and resource orientation shifted away from the coastal areas to the interior forests of the inter-riverine zone (DePratter and Howard 1980:10; Brooks and Scurry 1978). Although the gathering of shellfish apparently continued near the mouth of the Savannah River, along most of the coast shellfish gathering was largely abandoned. This shift away from shellfish gathering may be due to a hypothesized drop in sea level of approximately three to four meters below present between 3,000 and 2,400 years ago (DePratter and Howard 1980:10-12; Lepionka 1980). A drop in sea level would have lowered the salinity of the tidal creeks and reduced the extent and availability of salt marsh resources, and could account for the decreased reliance on shellfish. A drop in sea level would have also resulted in the burial of many sites from this time period under meters of marsh sediment, making them difficult to locate by conventional survey techniques (Marrinan 1975).

The Deptford phase (ca. 500 B.C.-A.D. 600), also identified along the Gulf coast, followed the Refuge phase along the Georgia-South Carolina coast. Deptford is frequently described as a coastal-dwelling culture whose subsistence centered on coastal resources (Milanich and Fairbanks 1980:66). However, our concept of the Deptford period may be biased, over-emphasizing the more obvious coastal adaptations at the expense of the inland sites (Brooks and Scurry 1978:3; Tesar 1980:78-79).

Deptford period shell middens are generally located adjacent to the marsh and are rarely deeply stratified (Milanich and Fairbanks 1980:67-68). They appear either as small, circular middens averaging 20 to 30 centimeters in thickness or as long continuous linear middens made up of small overlapping shell heaps (Milanich and Fairbanks 1980:72-73; Michie 1980:71-72). The middens are composed primarily of oyster shell, with few inclusions of other shellfish, and show little evidence of occupation other than the frequently found sand- and grit-tempered potsherds (Michie 1980:72; Milanich and Fairbanks 1980:67-68). Small burial mounds also appear at some coastal Deptford sites (Smith et al. 1981:88).

The seaward occurrence of many Deptford sites, some of which extend into the edge of the marsh at high tide, indicates that sea level during the Middle Woodland was somewhat lower than at present (Michie 1980:79; Milanich and Fairbanks 1980:67-68). By the Late Woodland, shell middens extend up the estuaries with distances comparable to Late Archaic sites, yet are generally smaller and without the species diversification of Late Archaic middens (Michie 1980:80). This, together with the absence of inundated sites, may indicate a higher sea level for the South Carolina-Georgia coast by the end of Woodland times (Michie 1980:79).

In Florida, the Woodland period, which began approximately 1200 B.C., is characterized by the beginning of formal, settled communities and more complex forms of political and religious organization (Milanich and Fairbanks 1980:20). Thoughout this period, in the St. Johns region of east Florida, which extends from south of Cape Canaveral to the St. Marys River, there was a continuation of the hunting, fishing, and collecting pattern that had been established during the Archaic. Changes occurred on the coast toward the end of the Woodland, when cultures such as Weeden Island were flourishing inland. Beginnning approximately A.D. 800, the villages in the area grew in size and number, there was a shift from gardening to more extensive forms of horticulture, and more complex forms of burial ceremonialism were introduced. However, during the Woodland, the most striking aspect of the Florida east coast was the strong cultural continuity (Milanich and Fairbanks 1980:147).

South Florida, which encompasses the southern third of the state, comprises three distinct culture areas: the Lake Okeechobee Basin, the Caloosahatchee area, and the Circum-Glades area. While the Lake Okeechobee Basin developed highly complex levels of social organization, the coastal areas were hindered by an environment largely unsuited for horticulture, and remained in a basically Archaic stage until historic times (Milanich and Fairbanks 1980:18-20,181). On the southwest coast, the Caloosahatchee area, which includes offshore keys, mangrove swamps, and piney flatwoods, is one of the least known and most puzzling areas in Florida (Milanich and Fairbanks 1980:181). Indians in this area built large, elaborate mounds and linear embankments of shell, such as the large Cash Mound site (8 Ch 38) in Pine Island Refuge.

The Circum-Glades area, which includes the extreme southern tip of the peninsula and the Florida Keys, was the last area in the state to be occupied, not being settled until approximately 1000 B.C. (Milanich and Fairbanks 1980:27). By 500 B.C. the distinctive Glades culture, with its special adaptations to tropical resources, was established. The basic patterns of subsistence and settlement included villages at the mouths of rivers or on the coastal lagoon; seasonal occupation of smaller inland sites; and hunting, fishing, and gathering without agriculture (Milanich and Fairbanks 1980:233).

The Deptford cultures, already discussed for the South Carolina-Georgia coast, represent an early Woodland occupation of the Florida Gulf coast from south of Tampa Bay to the Alabama-Florida line (Milanich and Fairbanks 1980:111; Tesar 1980:65). For the post-Deptford, pre-Weeden Island period on the peninsular Gulf coast (ca. A.D. 100-300) very little is known; however, research at the Shired Island West site (8 Di 7) and the Garden Patch site indicates that there was very little change in site location, midden distribution, or subsistence from the preceding Deptford times (Milanich and Fairbanks 1980:113-114).

In the northern, nonpeninsular part of Florida, the Swift Creek culture (A.D. 100-300), a Woodland culture originally identified in central Georgia, has been recognized. Although basically an inland-oriented culture with settlement in river valleys and highland forests where soils were suitable for horticulture, the Swift Creek culture is known to us primarily from excavations at coastal sites (Milanich and Fairbanks 1980:117-118; cf. Tesar 1980:106-107). The coastal sites are usually located near marsh edges or slightly back from the marshes in the hardwood hammocks (Milanich and Fairbanks 1980:117-118). Phelp's (1969) work at the Refuge Tower site, a Swift Creek habitation site located in the St. Marks Refuge, indicated two types of coastal sites: the midden dump with temporary residences nearby, and the infrequent circular midden generally associated with a village and burial mound.

Villages of the Weeden Island period (ca. A.D. 300-1200), a Middle to Late Woodland manifestation along the Gulf coast, are primarily represented by long linear embankments of shell. Parallel to the water or marsh, the village middens appear to be made up of a number of smaller circular middens that were originally deposited adjacent to individual households (Milanich and Fairbanks 1980:115). Horticulture was apparently growing in importance, and the increase in material goods found in the middens of Weeden Island times, together with an increase in the number of sites, indicates that the population size was larger (Milanich and Fairbanks 1980:115-116).

Much of our knowledge of the ceremonialism, religious beliefs, and social structure of Weeden Island cultures comes from the burial mounds of this period. Many of the burial mounds were excavated by Clarence B. Moore and other explorers in the late nineteenth and early twentieth centuries. Generally low, conoidal sand mounds, the burial mounds often contain large numbers of secondary burials of individuals previously stored in charnel houses, as well as "killed" pottery vessels and mortuary offerings (Walthall 1980:166). Continuous-use mounds and mounds constructed during a single ceremony are found on both the mainland and offshore keys of peninsular Florida, and, in the Early Weeden Island period, in northern Florida. Patterned burial mounds with east-side pottery caches are found only in northern and northwestern Florida (Milanich and Fairbanks 1980:137-139; Tesar 1980:93; Sears 1958; 1962).

Around A.D. 800-1000, temple mounds were introduced along the northwestern coast of Florida, and there was a shift from continuous-use to single-deposit burial mounds. There were also major social changes for the northwestern coast at this time, coincident with the beginnings of Mississippian influences in the area (Sears 1958).

Westward, in the Mobile Bay area, ceramics of the Bayou La Batre culture mark the earliest appearance of coiled, grit-tempered ceramics in the Alabama region (Walthall 1980:95). Chronologically Bayou La Batre ceramics come after Late Archaic fiber-tempered ceramics and before Porter phase ceramics. The Middle Woodland Porter phase people inhabited the shores of Mobile Bay and the surrounding Gulf coastal plain, apparently traded extensively, and had contact with the Swift Creek people to the east and the Marksville-Troyville people to the west. In coastal areas, the Porter phase sites include aquatic-oriented collection sites and village middens, as well as some of the earliest burial mounds in the Southeast (Walthall 1980:107,155-158).

In coastal Louisiana, Poverty Point, a transitional Late Archaic-Woodland culture (ca. 1500-500 B.C.) was the first culture to have intensively exploited the Louisiana delta environment (Springer 1973:29-30). Poverty Point, primarily known from the large, elaborate site in northern Louisiana, was among the earliest of the mound-building cultures in Eastern North America. Although the social organization was elaborate, perhaps reaching the chiefdom level, the basic economy remained one of hunting, fishing, and gathering. Most coastal sites from this period are Rangia shell middens, many of which have been exposed by wave erosion or canal construction (Burden et al. 1978; Gagliano and Saucier 1963).

Following Poverty Point was the Tchefuncte period. The Tchefuncte people had a simplified lifeway compared to the Poverty Point people, although they did develop a rather elaborate ceramic complex. Settlement during the Tchefuncte period was concentrated in the coastal areas, and people lived in small scattered settlements (Springer 1973:33).

During the Marksville period (ca. A.D. 250-700) and the Coles Creek-Plaquemine period (ca. A.D. 700-1600), the Archaic-like fishing, hunting, and gathering economy continued in coastal Louisiana, even though the mainstream cultures in the interior alluvial valleys were agriculturally based (Duhe 1981; Gagliano et al. 1975:18; Larson 1980:222). Although successful in producing a livelihood, the coastal Coles Creek-Plaquemine people did not have the same levels of social, political, or economic complexity that inland Coles Creek-Placquemine groups did (Duhe 1981).

For southwestern Louisiana, where the Sabine and Lacassine refuges are located, the ceramic sequence is unknown. Sequences from the Lower Missssissippi Valley to the east and Texas to the west, once applied to the region, are now recognized as inadequate (Thomas et al. 1978:21-25). For this reason, sites such as the Onion Hill site, an in situ yet partially eroded shell and black earth midden in the Lacassine Refuge, offer much in the way of research potential for the Woodland and other periods of prehistory.

### The Mississippian Period (ca. A.D. 950-1540)

The Mississippian period was the latest and most complex prehistoric period in the Southeast. Often defined as an economic and sociopolitical complex common to societies dependent on agricultural crops as their basic storable food supply, the Mississippian had its major development in the rich floodplains of the central Mississippi Valley. In the Southeast, many of the ceremonial and sociopolitical aspects of the Mississippian lifestyle were adopted by coastal cultures who retained their own traditonal subsistence adaptations, never seriously adopting agriculture (Milanich and Fairbanks 1980:166,210). The traits that characterized the Mississippian lifestyle included platform mounds, villages arranged around a plaza, elaborate ceramics, class structure, and organization into complex societies (Dragoo 1976).

Mississippian influences were not strong everywhere in the Southeast, and in some areas Woodland period adaptations persisted up until the time of European contact. This is so in our study area for the coastal areas of North Carolina (Willey and Phillips 1958; Anthony and Drucker 1981:21). For the North Carolina coast, the late prehistoric and early historic periods saw the continuation of a Woodland-style subsistence pattern of hunting, gathering, and horticulture. Cultivated plants included maize, beans, pumpkins, squash and gourds, while wild plant foods such as grapes, berries, acorns and edible roots were collected (Haag 1956:17-19; Loftfield 1976:239). Ethnohistoric accounts describe seasonal transhumance between the inland river systems of the coastal plain in the fall and winter, and the barrier islands and estuaries in the spring and summer months, although historic and prehistoric populations may have occupied estuarine environments year-round (Anthony and Drucker 1981:21).

For the South Carolina coast, Mississippian settlement was apparently oriented around mound-village complexes. Ceremonial and political centers, with large earthen mounds where high status individuals lived or were buried, were distributed at regular intervals along the major drainages of the region (Anderson and Claggett 1979). However, the majority of sites were lesser villages or special activity areas (Anderson and Logan 1981:22).

For the South Carolina-Georgia coast three Mississippian phases have been identified. The St. Catherine phase (ca. A.D. 950-1000) shows a decrease in small sites from the earlier Woodland period, with most sites located on the high, well-drained parts of Pleistocene barrier islands (DePratter and Howard 1980:16). The Savannah phase (ca. A.D. 1000-1350) shows a continuation of the trend towards highly nucleated villages. Fewer and fewer small sites appear, and more people occupied major communities. The larger communities contained a hundred or more houses and had one or more large burial mounds (DePratter and Howard 1980:17-19). During the Irene phase (ca. A.D. 1350-1550), which is the archeological equivalent of the historic Guale, the trend reversed as an increasing number of smaller villages and homesteads were occupied and large towns lost their importance as major religious and social centers (DePratter and Howard 1980:19). The reasons for the shift from a nucleated Savannah phase settlement system to a more dispersed pattern during the Irene phase are unknown, but the major factors are apparently other than subsistence (Pearson 1980). Though subsistence data are scanty, they indicate a heavy reliance on marsh-estuarine resources for both the Savannah and Irene phases, with shellfish remains, especially oyster, constituting the bulk of cultural debris at most sites (Pearson 1978:57).

The apparent unimportance of horticulture on the Georgia-South Carolina coast is probably due to the low fertility of the coastal soils and the unlimited abundance of marsh-estuary resources (Pearson 1980:57). On the Atlantic coast, soils suitable for agriculture occurred in small, widely scattered patches that were cultivated by isolated families (Larson 1980:219,221). The sandiness of the soil and its low fertility made it necessary for the families to switch fields, and thus residences, often. Large, stable villages were impossible with this pattern of farming, and so the residence of the paramount chief served many of the purposes of the village (Larson 1980:219). In sharp contrast are the interior areas of the Southeast, where soils were more fertile and the levels of production were high enough to support dense populations in large villages (Larson 1980:221-222).

Moving south into the St. Johns region of Florida, cultivation becomes less and less important towards Cape Canaveral, below which it disappears altogether (Larson 1980:218). However, several Mississippian traits appear in the St. Johns area by about A.D. 1000. A few large ceremonial centers, indicating that the region was organized into complex societies, appear, as do sporadic instances of artifacts with Southern Cult motifs (Larson 1980; Milanich and Fairbanks 1980:164). Apparently the people in the St. Johns region maintained their own subsistence adaptations, yet shared some of the ceremonial and political aspects of the Mississippian tradition that were widespread throughout the Southeast (Milanich and Fairbanks 1980:29,166).

South of the St. Johns region, the Circum-Glades tradition remained oriented toward hunting, gathering, and fishing (Larson 1980). While the early Glades cultures had not been much influenced by outside cultural influences during the Woodland, later Glades cultures were influenced by the Mississippian Lake Okeechobee tradition in the interior. Apparently, a reciprocal trade alliance operated between the St. Johns and Glades traditions, with the St. Johns people supplying horticultural products to the Glades people in exchange for palmetto berries, zamia, and various sea animals (Larson 1980).

Along the peninsular Gulf coast of Florida, the Mississippian Safety Harbor culture (A.D. 1000-1540) reached from Tarpon Springs south to Sarasota (Milanich and Fairbanks 1980:25,204). Large Safety Harbor village sites were regularly distributed along the coast. Associated with the villages were temple mounds built by discrete periodic additions which may have been associated with religous ceremonies. Supporting either the residence of the chief or elaborate ceremonial buildings, the mounds were located immediately north or east of a plaza and had ramps providing access to the summit (Luer and Almy 1981). Smaller Safety Harbor sites do not have associated temple mounds, which suggests that inhabitants of the small sites gravitated towards the larger coastal sites. Historic accounts support the idea that there were many villages near Tampa Bay with "lesser chiefs" who paid allegiance to an important chief of a larger coastal village (Luer and

Almy 1981). Although it is likely that maize agriculture was practiced, we have no archeological evidence for it, and Safety Harbor people remained largely hunter-gatherers and fishers (Milanich and Fairbanks 1980:209; Luer and Almy 1981). Toward the end of the Safety Harbor period, European artifacts are found in some of the mounds, and the Tocobaga Indians are recognized as the historical equivalent of the Safety Harbor people.

In northwest Florida, the Mississippian tradition is represented by the Fort Walton and Pensacola cultures, which are distinguished from one another on the basis of geographical differences as well as differences in ceramic types (Milanich and Fairbanks 1980:193; Walthall 1980:263). The sand- and/or grit-tempered pottery of the Fort Walton culture predominates from the Apalachicola River east to the Aucilla River, while the primarily shell-tempered pottery of the Pensacola culture is found west of the Apalachicola drainage as far as Mobile Bay in Alabama (Milanich and Fairbanks 1980:193). Between the two areas, there are mixed assemblages of the two temper groups, with the relative percentage of sand-tempered ceramics decreasing as one moves west (Walthall 1980:263). To the west, between Mobile Bay and St. Andrews Bay, major sites appear to consist of a large platform mound without a plaza or subsidiary mounds, and are located on barrier beaches in protected bays near estuaries (Brose and Percy 1978:100). To the east, between St. Marks Bay and the Aucilla, the coastal Fort Walton sites apparently consist entirely of small, seasonally reoccupied sites, with few if any large ceremonial sites or cemeteries (Brose and Percy 1978:101). Both of these settlement patterns contrast with those of the Tallahassee Red Hills and Apalachicola River Basin, which also seem to have been focal areas for Fort Walton populations (Milanich and Fairbanks 1980:196; Brose and Percy 1978:101). Apparently there was both an interior Fort Walton adaptation based on agriculture, and a coastal Fort Walton adaptation based on estuarine resources, with trade networks between inland and coastal communities (Milanich and Fairbanks 1980:203).

In coastal Louisiana, the Plaquemine-Mississippian culture, which includes both prehistoric and early historic villages, is marked by the introduction of shell-tempered pottery often decorated with Southern Cult motifs (Gagliano et al. 1975). Distribution of pottery was greatest in the southeastern part of the state, where Plaquemine population densities were also greatest, indicating an eastern Gulf coast origin (Gagliano et al. 1975; Springer 1973:35). During the early Historic period, and perhaps during the late prehistoric, southwestern Louisiana was an area of low population density (Smith et al. 1983:65,292). The area is relatively unknown archeologically, and research in the Sabine or Lacassine refuges is needed to answer basic questions about the prehistoric culture sequence in the area.

# CHAPTER V

# EROSION: CAUSE AND CONTROL

The wearing away of coastal lands by erosion is the result of a complex set of interacting geological, hydrological, and climatic forces. The primary causes of coastal erosion include the rise of sea level, land subsidence, winds, tides, currents, and storm waves. By expanding development along the shoreline and altering natural processes, humans have become a significant factor in erosion, hastening the effects of erosion in particular areas. Humans have also sought to impede erosion in other areas by the use of erosion control measures. Such measures often meet with success, but if not carefully implemented they can increase erosion in nearby areas or intensify long-term erosional problems.

## Causes

The major cause of coastal erosion has been the post-glacial rise in sea level that began approximately 17,000 years ago. This rise was fairly rapid during most of the Holocene, but slowed considerably approximately 3,000 or 4,000 years ago. In the last century, mean sea level rose approximately 10 to 20 centimeters (Rampino 1979). Due to increased global warming, the rate of sea level rise is expected to increase substantially in the future, causing an increase in coastal erosion, inundation of low-lying lands, and storm damage (Gornitz et al. 1982). According to conservative estimates, sea level will rise twice as fast as its historical rate during the next 20 years, then increase to four times that rate from 2000 to 2025 (Hoffman 1983:31). Since along many areas of the southeastern coast a rise in sea level of even one meter would cause a shoreline retreat of more than 100 feet (Hoffman 1983:31, 45-46), even a slight rise in sea level could have a serious impact on coastal archeological sites, and the possible effects of this should be considered in any long-term planning.

In some coastal areas, subsidence, the downward movement of land masses, combines with the rise of sea level to produce an accelerated rate of erosion. In Louisiana, where subsidence rates range from 0.4 feet to 10 feet per century, many archeological sites have sunk below the level of the marsh surface, posing a potential bias for archeological inventories and research (Shelley 1981).

More immediate causes of erosion are meteorological and hydrological forces such as tides, winds, waves, currents, and storms. Tides, the periodic rise and fall of the sea, result from the gravitational attraction of the moon and sun. They vary in frequency and range, with the Atlantic coast having semidiurnal tides (two nearly equal high waters and two nearly equal low waters each tidal day) ranging from 3 to 8 feet, and the Gulf coast having diurnal or mixed tides that range between 1 and 2 feet.

In marshlands the shift in tides produces a low velocity exchange between high and low water in the small tidal creeks, but causes a rapid, forceful flow of water in the major stream channels. The erosional force of the tidal shift is evident at several of the refuges. Pinckney Island on the Georgia-South Carolina coast is almost completely circled by linear shell middens. Located on the ecotonal break between the marsh and uplands, the middens have been damaged by the rapid tidal shift and some have been completely destroyed (Braley 1982a; Drucker and Anthony 1980).

On the Harris Neck Refuge, the Bertram Fish Camp Property, part of the larger, National Register-eligible site 9 McI 41, has been determined an ineligible site remnant due to the disturbance of the property (Drucker 1982b). Contributing to the disturbance has been the loss of approximately 90 feet of the property to creek erosion in the past 30 years, an average of 3 feet per year.

Even in areas of low tidal range, regular tides can cause extensive damage. At the Naval Live Oaks Reservation in the Gulf Islands, the small neap tides that occur during quarter moons have eroded portions of the peninsula by as much as 20 feet in a 24 hour period (Huston and Stoutamire 1982:5).

Waves, another source of erosion, are normally produced by winds blowing over the water surface. However, water depth, wind speed, and fetch length, which is the water distance over which wind blows to generate waves, contribute to the size and force of waves. Waves act on some archeological sites by washing over them, but with archeological sites located above the water line on vertical cut-banks or bluffs, wave action at the toe of the bluff undercuts the base, causing large chunks of the matrix to fall off and slump into the water (Gramann 1982).

Coastal areas are often classified according to wave-energy levels, with segments of the coast ranked as high, moderate, low, or zero wave-energy. Unfortunately, simple correlations between high and low wave-energy areas and overall erosional damage to archeological sites cannot be made. For example, the Shired Island West site, a site recommended as eligible for the National Register, is located in the Lower Suwannee Refuge in a zero wave-energy area of the Florida coast. However, the site, with its Gulf exposure to the south and west, suffers heavy erosional damage. Intensive wave action has caused trees carrying part of the midden matrix to tumble overnight, and large areas to disappear in a matter of months (Figure 10). The refuge manager remembers the site extending 6 to 8 meters further out than it does now (J. Gambel, personal communication 1983), and the locations of the excavations carried out there in 1951 by John Goggin are now below high tide level (Dorian and Stoutamire 1981). Clearly, the zero wave-energy label for that section of the coast belies the actual amount of localized erosional damage.

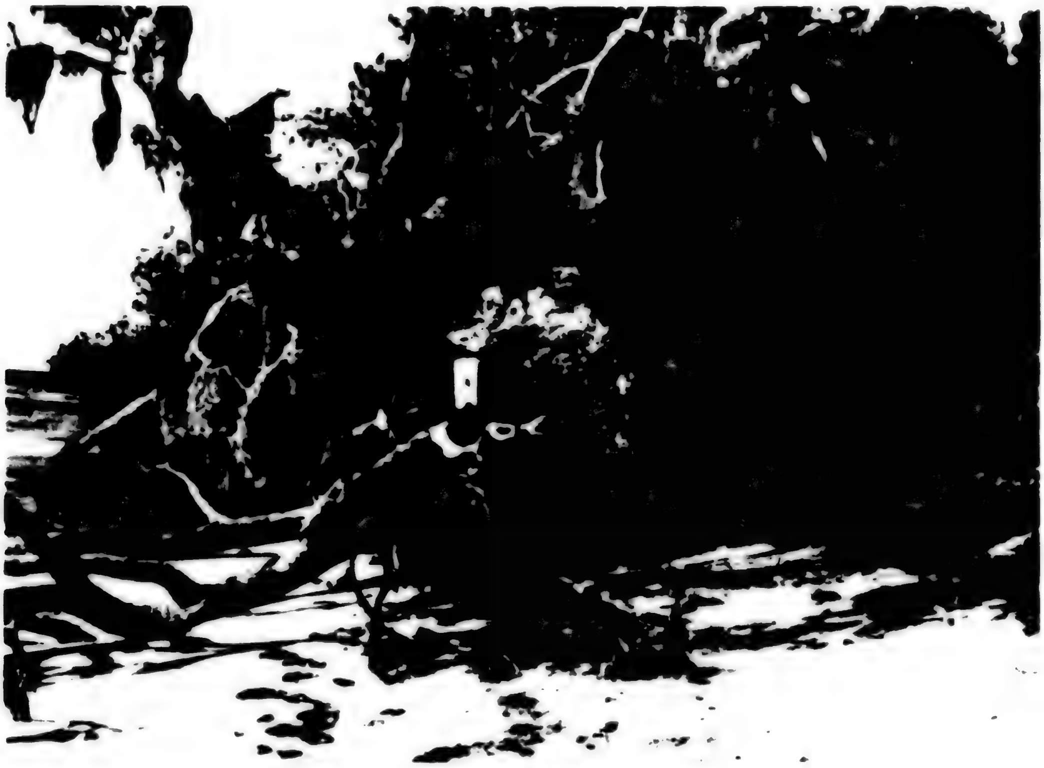

Figure 10. Shired Island West site (8 Di 7), showing erosional damage.

In some areas, currents and littoral drift are major causes of erosion. Deep ocean currents, produced by differences in the densities of water strata, rarely affect archeological sites as directly as do surface currents and tidal currents. Surface currents, which form in response to prevailing wind patterns, together with alongshore currents in the breaker zone, are largely responsible for the directional movement of littoral materials along a shoreline. Human activity in the form of dredging or channelization can alter currents, increasing or shifting the focus of their erosive force, and accelerating the damage to an archeological site.

The greatest amount of natural erosional damage, however, comes during coastal storms, which, with their related wind and wave activity, can cause dramatic and rapid damage (Spiess 1981; Huston and Stoutamire 1982; Fryman et al. 1980; Braley 1982a). The low pressure center associated with tropical storms and hurricanes causes higher than normal water levels along the coast by "sucking-in" water from surrounding high-pressure areas (Spiess 1981). The higher water levels, together with winds that are sometimes greater than 175 miles per hour, result in a "storm surge," a huge mass of water that can have disastrous effects when it hits the shore. Storm frequencies vary throughout the Southeast, but most areas average at least one small storm per year. Larger, more destructive storms are less predictable, but over 111 hurricanes hit the southeastern coast within a 57 year period between 1900 and 1957 (Dunn and Miller 1960:52).

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Northeasters, which are extratropical storms passing from west to east, can cause formidable damage as evidenced by the Ash Wednesday storm of 1962. This storm, with its 20 foot waves, opened inlets and altered coastlines the length of the Atlantic coast from New England to Georgia.

The damage to archeological sites during storms can be immense. In the Hobe Sound Refuge, the entire eastern half of the Joseph Reed Mound, a probable Late Archaic shell ring, was lost during a single hurricane. Maps showing approximate shoreline positions from 1887 to 1974 indicate an average rate of erosion of 15 feet per year at the site. A realistic interpretation of the data is that within the next 35 years or so one or more major hurricanes will occur and destroy the remaining portion of the site (Fryman et al. 1980). Haag (1956:25) reports that erosion removed 30 feet from a site in North Carolina, and more was removed during the violent attack of Hurricane Connie in 1955.

In addition to natural erosion, human-induced erosional damage is a major factor hastening site destruction. Historically, human activities--dredging, diking, and ditching of marshlands, and borrowing midden shell for road construction or for the liming of fields--have destroyed a large part of the coastal archeological record (Figure 11). Wildlife refuges are no exception, since some management practices, necessary for the fulfillment of various refuge functions, adversely impact archeological sites by accelerating natural erosion (Marrinan 1979).

Figure 11. Bayside exposure of Cash Mound (8 Ch 38) in the Island Bay Refuge. The site was heavily disturbed when an oystershell company stole shell from the site in the 1960s.

A mixed blessing, dredging has destroyed numerous sites while allowing for several significant archeological discoveries in the coastal areas. In areas where subsidence or sedimentation has caused sites to lose their surface expression, the subsurface disturbance caused by dredging frequently exposes sites in cut-banks. In addition to making "masked" sites visible, dredging has also led to the recognition of drowned terrestrial sites (e.g., Goodyear et al. 1980; Warren 1964; Bullen 1969).

There are two methods of dredging, each of which impacts sites differently. With dragline dredging, a large bucket scoops up bottom sediment and dumps it as spoil on the bank. These large chunks of sediment maintain their basic stratigraphic integrity, and some of the excavation techniques archeologists use in examining in situ materials can be used in examining this type of dragline spoil (Gagliano et al. 1975:54). With hydraulic suction dredges, however, the spoil is completely mixed and disturbed and data recovery is more difficult. Hydraulic dredge spoil is discharged as slurry spilling out of the tail pipe of the dredge in a cone or mound. While important contextual data are lost, other invaluable archeological material can be recovered from the spoil. Soil borings may be used in conjunction with these studies to reconstruct some of the stratigraphic data and provide some context for recovered material (Gagliano et al. 1975:54).

The Corps of Engineers operates maintenance dredging of the Gulf and Atlantic Intracoastal Waterways, both of which cut through several refuge properties. Archeological sites on some of the refuges are eroding into the waterways, but evaluations or field checks of site conditions have not been systematically carried out except for a few portions of the waterway (e.g., Gagliano et al. 1975).

Dredging is also involved in the construction and maintenance of water impoundments in the refuges. The widespread use of dikes and ditches in the tidal floodlands goes back to the 1700s when colonists constructed earthworks to create adequate growing conditions for rice (see Marrinan 1979). Many of the old rice fields, abandoned in the late 1800s, have been readapted for use by the Fish and Wildlife Service as impoundments for the feeding of migratory waterfowl and wading birds. Management practices for the pools vary, but there is usually a seasonal drawdown followed by disking or burning. Cleaning of the canals in the course of normal maintenance may destroy sites or accelerate erosion. In the Savannah Refuge, the Second Refuge Site (38 Ja 61), important in the reinterpretation of the Refuge phase, was exposed in profile on an island cut during the construction of the impoundment in the 1930s. The site had been subsequently altered by canal-induced erosion and would have been destroyed by proposed maintenance dredging (Marrinan 1979). However, the site was subjected to a program of data recovery, after which the planned dredging was accomplished without damaging the remainder of the site (Lepionka et al. 1983).

Other management practices, particularly those allowing for increased public access to archeological sites, may compound the erosional damage to sites. Foot and bike paths along the bluff line adjacent to sites may destabilize the bluffs and cause slumping. The accelerated damage this can cause was observed for two sites in the Gulf Islands by Huston and Stoutamire (1982:5). Increased public access in the form of recreational boating also takes its toll, since waves from boat traffic increase erosional damage to sites along the banks of the stream or channel (Gramann 1982). Finally, increased public access to a site can increase the potential for vandalism, itself a major threat to archeological resources along the coast.

## Erosion Control

Erosion control is a frequently suggested but seldom implemented mitigation alternative for eroding coastal sites. Little is known about the actual mechanics and less still about the long-term implications of archeological site preservation in coastal areas. Erosion control measures have been adapted to physically protect archeological sites along rivers and along reservoir and lake shorelines, and many problems concerning site protection have been addressed in this context (D. Derven, personal communication 1983; S. Riggle, personal communication 1983; R. Eichorn, personal communication 1983; Lenihan et al. 1981; Gramann 1982; Nielsen and Keel 1983). However, in coastal areas, where climatic, geologic, and hydrologic forces are especially complex, erosion control is more problematic and considerable experimentation with site protection is still needed.

Physical means of shoreline protection are either one of two types, structural or non-structural. Structural measures include bulkheads, seawalls, revetments, offshore breakwaters, and jetties, while the major non-structural alternative is the planting of vegetation to stabilize an area. The choice of which erosion control measure to use will depend on the nature of archeological site and on factors such as wave exposure, near-shore water depth, fetch length, and general shoreline configuration.

Because erosion control measures may have complex secondary effects detrimental to the surrounding environment, any attempt to modify a portion of the coastline by the construction of erosion control works requires the understanding of all factors and processes at work in the coastal system (Simonsen 1979:17). Any structure placed below the mean high water line requires a Federal permit, issued under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act of 1977. Permit forms are available from the district offices of the U. S. Army Corps of Engineers.

The descriptions of erosion control measures presented here are based largely on the shore protection guidelines prepared by the Coastal Engineering Research Center of the U.S. Army Corps of Engineers (e.g., U.S. Army Corps of Engineers 1981; Knutson and Inskeep 1982; Woodhouse 1979). Most measures are intended for use on sites in sheltered waters. Open coast sites receive the full force of storms and ocean waves, and control measures on these sites are more likely to fail. Most measures that are successful for open coast areas are prohibitively expensive, with large-scale beach nourishment projects averaging one million dollars per linear mile. A possible exception is the recent use of artificial seaweed "planted" in the Atlantic, which has proven effective in protecting an important historical cultural resource, the Cape Hatteras Lighthouse, at a fraction of the cost of traditional erosion control measures.

Bulkheads and seawalls are structures placed parallel or nearly parallel to the shoreline, and separate a land area from a water area. Both bulkheads and seawalls serve as retaining walls to prevent the sliding of soil and protect the upland area from wave damage. Constructed out of a variety of materials, they may be thin structures driven deep into the ground, such as sheet piling, or heavy structures resting on the surface. Their vertical faces tend to deflect wave energy downward and erode the base, eventually causing collapse of the structure. Like other shore protection devices, bulkheads and seawalls protect against regular wave action, but are not a safeguard against severe storm weather. Constructing bulkheads and seawalls customarily requires the use of heavy equipment, which makes archeological site accessibility and potential disturbance to a site important constraining factors.

Bulkheads and seawalls vary in design depending on whether a small midden or a large mound site is to be protected. One of the few examples of a shoreline stabilization work associated with a midden site is the seawall protecting the Ministers Island site in New Brunswick, Canada. The Ministers Island midden was losing approximately 20 centimeters per year to erosion before the relatively low-cost seawall, built of gabions, was constructed in 1979 (Ferguson and Turnbull 1980).

As described by Ferguson and Turnbull (1980), the first phase of the project was preparing the seaward edge of the site. The front of the site was excavated along an arbitrary east-west line, and the earthen wall created was slanted inland 6 to 8 degrees to increase its stability (Figure 12). The excavations of the cultural layers in this phase were conducted as a data recovery project, with all deposits and faunal remains carefully recorded and analyzed. However, once the cultural layers had been removed down to sterile subsoil, a bulldozer was brought in to level the remaining material.

To prevent scouring of the base, a shallow trench was dug along the length of the wall, about 60 centimeters in front of the site. The trench, together with the wall, was lined with a water-permeable polyethelene filter cloth before being filled with riprap. Filter cloth, an important design element in most erosion control works, prevents the escape of the soil but allows ground-water to circulate.

Constructing the seawall with gabions was the final step in the project (Figure 13). Gabions are rectangular, open-mesh wire baskets, which, when filled with rocks and cobbles, are used in a variety of erosion control efforts. Gabions are flexible, pervious to water, and create a suitable base for soil accumulation and vegetation growth (Spiess 1981). Individual gabions come collapsed, are filled with rock, laced together, and placed tier after tier in front of the prepared site front until the desired seawall height is reached.

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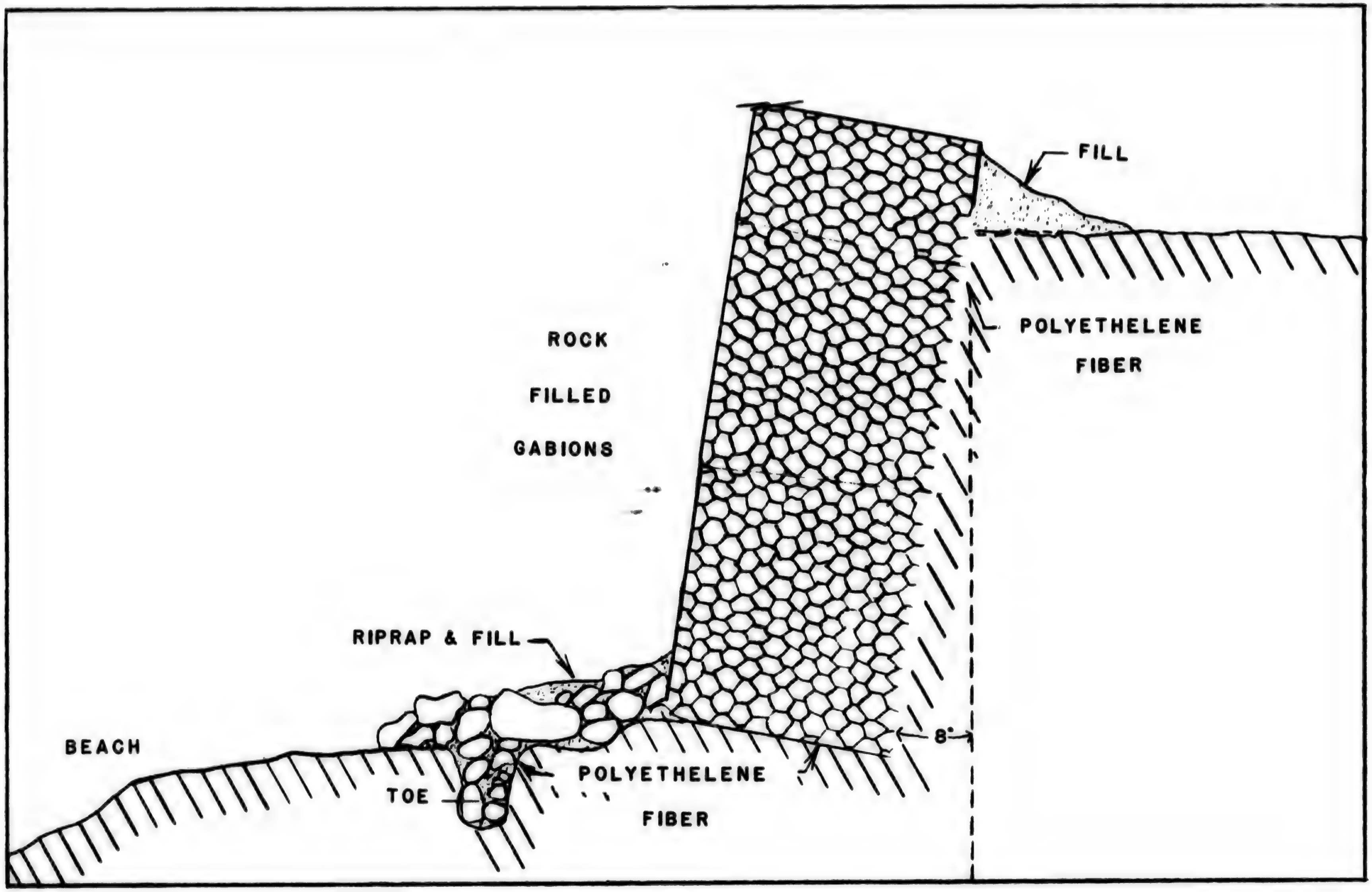

Figure 12. Diagram of seawall constructed at the Ministers Island site in New Brunswick, Canada. (From Ferguson and Turnbull 1980)

Figure 13. Construction of the seawall at Ministers Island. (Photo courtesy of Christopher Turnbull, Provincial Archaeologist, New Brunswick)

The completed wall on Minister's Island is 40 meters long and over 2 meters high in places. The project required approximately 67 worker-weeks, with a crew of four during the actual construction of the wall. Since rocks for gabion filling were locally available and volunteer labor was used, costs were kept to $300 per meter, for a total project cost of $12,000. The seawall has successfully withstood the tail end of a major hurricane, but it is likely that the wire of the baskets will be disintegrated by the salt water, despite the fact they are heavily galvanized. The life-span of the structure is as yet unknown, but the seawall is expected to protect the site for some years to come (C. Turnbull, personal communication 1983).

Bulkheads for large mound sites present a different range of design problems. Often, disturbance to the site can only be avoided by placing the equipment on barges and, in the case of sheet-piling, driving the piling from offshore. This can be highly expensive. For example, the sheet-piling used to protect two Rood Creek mound sites at the Walter F. George Lake and Dam cost approximately $295,000 for several hundred linear feet (Nielsen and Keel 1983). At the Shiloh National Military Park and Cemetery, where a Mississippian mound site is eroding into the Tennessee River, 380 linear feet of an adjacent area were protected by bulkheading for approximately $321,000 (Figure 14). Another $250,000 is being spent on a study of the different erosion control alternatives for the rest of the park.

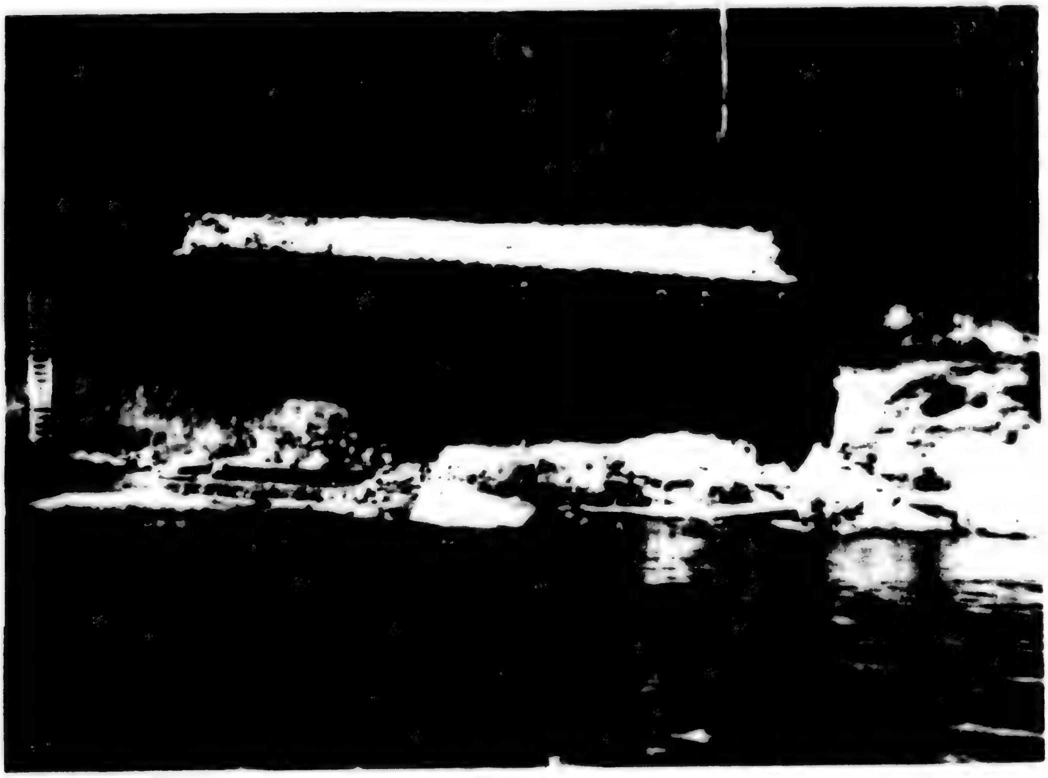

Figure 14. **Bulkhead protecting** property at the Shiloh National Park and Cemetery, Tennessee. (Photo courtesy of John Wilburn, National Park Service)

Revetments, another form of erosion control, are heavy facings placed on a slope to absorb the energy of incoming waves. They have three components--an armor layer, a filter layer, and a toe protection (Figure 15). The armor layer, typically composed of rock riprap, asphaltic concrete, or variously shaped concrete blocks, actually takes the attack of the waves, while the filter layer prevents removal of the underlying soil, and the toe protection prevents destruction of the revetment's seaward edge. Along reservoir shorelines and canals, liquid concrete, also known as shotcrete or gunite, has been used in revetment-like structures (Ware 1981). Sprayed on over a heavy wire mesh held into the ground by steel pins, liquid concrete is successfully being adapted for archeological site protection by the Corps of Engineers at several lake sites (D. Derven, personal communication 1983). Its usefulness in protecting coastal, as opposed to lakeshore sites, has not been explored.

Heavy equipment is generally needed in constructing a revetment, and the weight of a revetment may cause compaction damage to sites. Revetments depend on the soil beneath them for support, and can only be built on stable shores. Slopes greater than 1:2 are unsuitable for revetments unless graded. Since grading involves destruction of part of the site itself, a data recovery program would be needed to mitigate the adverse effects.

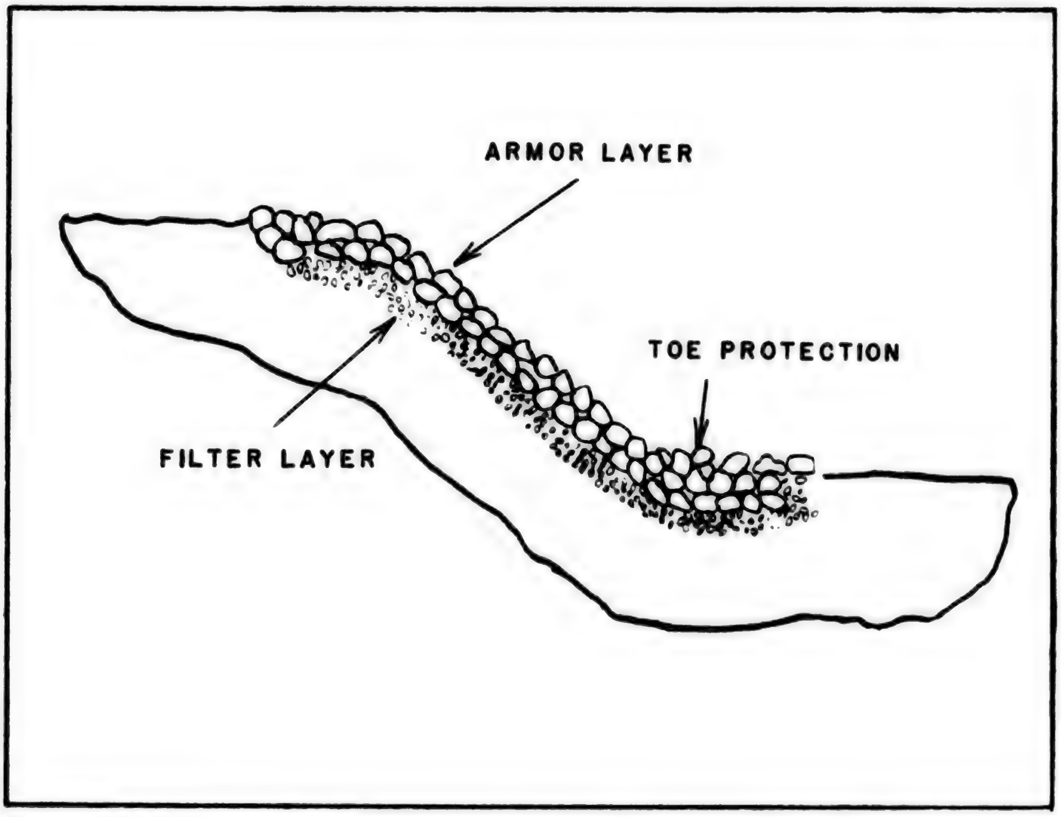

Figure 15. Profile of a revetment, showing armor layer, filter layer, and toe protection. (After U.S. Army Corps of Engineers 1981)

A loose rock riprap revetment has been used to protect the Fernald Point site in the Acadia National Park in Maine (Sanger 1980) (Figure 16). A stratified midden at the mouth of the estuary, the site was previously exposed to 8 to 9 foot waves, shore currents, and storm waves. Approximately 40 meters of an erosion scarp were covered by loose riprap in 1977, at a cost of about $3,000. Monitored yearly, the rock revetment has kept the site from being destroyed, even though winter storms have damaged the original riprap. The revetment also disguises the fact that the area is an archeological site, and therefore protects it from vandalism (D. Sanger, personal communication 1983). Still, the riprap is only a short-term solution, since the rocks themselves are subject to dispersion during storms (Spiess 1981).

Offshore breakwaters and jetties are other structural measures commonly used to protect commercial or recreational lands, but which have not been used to protect archeological sites. Breakwaters, structures placed in the water parallel to the shore, and jetties, finger-like projections extending into the water perpendicular to the shore, both work by accumulating sand behind them, while depriving the downdrift beach of its normal sediment supply. However, breakwaters and jetties are most suitable for areas where beaches are desired, and since they do not function in clayey or silty areas it is unlikely that they would be useful for protecting many archeological sites.

Figure 16. Rock revetment at the Fernald Point site in Acadia National Park, Maine. (Photo courtesy of David Sanger, University of Maine.

Vegetation, important in most natural settings, has been used as a non-structural erosion control measure in sheltered bays, sounds, and estuaries, and may have potential for protecting coastal archeological sites. Upland grass species work by trapping sand and stabilizing beaches and dunes, while grasses, sedges, and rushes are planted to establish marshes in the intertidal zone. Because of the ecological sensitivity of wetlands, vegetation is the only appropriate measure of erosion control in marsh itself (U.S. Army Corps of Engineers 1981:34). Establishing vegetation does not require the use of heavy equipment, making it a practical measure for inaccessible sites that would be difficult to protect structurally. Vegetation is the least expensive means of erosion control, and should be particularly attractive to the Fish and Wildlife Service since this solution also has habitat value for waterfowl (R. Saucier, personal communication 1983).

Site suitability for planting marsh grasses is determined by the wave climate, itself a function of fetch length, shore configuration, and sediment grain size (Knutson and Inskeep 1982). Generally, marsh grasses grow along moderate to low energy shorelines, and cannot withstand high energy conditions on open coasts. Different plant species are appropriate for various local conditions of soil types, salinity regimes, and tidal ranges (Knutson and Inskeep 1982; Woodhouse 1979; U.S. Army Corps of Engineers 1981). Smooth cordgrass (Spartina alterniflora) is the dominant species for most intertidal zones in the Southeast, although south of Daytona Beach, Florida, the typical Gulf and Atlantic marshes are largely replaced by mangrove trees that form the subtropical equivalent of salt marshes (Woodhouse 1979).

Potential root disturbance to sites is a major drawback in using vegetation as an archeological site conservation measure. Most marsh grasses have root systems extending one-third of a meter into the soil, which may or may not constitute a major disturbance to a site (P. Knutson, personal communication 1982; R. Saucier, personal communication 1983). In upland areas, commercially available soil reinforcement mattings may be used to provide a matrix for the root growth. These mattings lessen the disturbance to the underlying soil, and also serve as a deterrent to the casual vandal, since they make the vegetative cover extremely stable and difficult to dislodge or uproot (D. Derven, personal communication 1983).

A second potential problem is the use of chemical fertilizers, which may alter osteological remains or palynological data in the site matrix. Limitations of vegetation as a protective measure are that it is fragile, does not always stand up to storm activity, and has a limited life-span. Planted marshes, like natural marshes, proceed through a cycle of establishment, stability, and erosion, with planted marshes having a design life of five to ten years (Knutson and Inskeep 1982).

In summary, though the causes and effects of erosion can be generalized, erosional problems at individual sites vary widely in type and intensity. Methods of erosion control are likewise diverse, varying in design, potential applications, and cost. Definition and solutions to erosional damage, then, are matters that require detailed investigation at each individual site.

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# CHAPTER VI

# MANAGEMENT RECOMMENDATIONS

The Southeastern Region of the Fish and Wildlife Service has over 400 archeological sites in its coastal refuges, and over one-quarter of these are being damaged by erosion. Priorities for the identification, evaluation, and treatment of these resources must be established, and innovative means of treatment explored. Preservation plans, which should incorporate regional or state-wide research designs, must also reflect the fact that each archeological site is unique and that the factors affecting each site vary widely.

This chapter reviews the Service's policy on cultural resources, outlines the steps prerequisite to an effective cultural resource management program, and recommends a systematic program of inventory, evaluation, and treatment of significant sites within the national wildlife refuges. The chapter also reviews available treatment options for eroding sites, and highlights the recommendations resulting from the study.

Appendix A, an integral part of this study, summarizes the data on the known cultural resources on each refuge. The appendix points to important data gaps, the potential for significant cultural resources on the refuges, threats to these resources, and other information useful in setting priorities for future archeological work. Appendix B provides, in summary form, priority rankings for all the coastal refuges with respect to survey, testing and evaluation, and monitoring.

## Policy

The Fish and Wildlife Service recognizes that prehistoric properties represent an important, non-renewable resource. It is the Service's general policy to provide the fullest protection possible to the resources under their jurisdiction and to avoid inadvertant loss or destruction of archeological sites (U.S. Fish and Wildlife Service 1982:5 RM 16; U.S. Fish and Wildlife Service 1983). On Service lands, cultural resources are mostly unidentified, and so it is the specific policy of the Service to locate and evaluate cultural resources prior to any undertakings that could affect cultural resources. The Service realizes that neglect of significant cultural properties may result in adverse impacts to these properties, and will take any necessary and feasible steps to prevent destruction due to neglect (U.S. Fish and Wildlife Service 1983). Finally, the Service acknowledges that regional cultural resource programs must be accorded the same intensity of planning and management consideration now given other resource programs. The region's cultural resource program must be an integral component of the overall planning system, and there must be sufficient funding to support a strong cultural resource program.

## Resource Planning

Resource planning, crucial to the management of the refuge system, provides a framework for stable and consistent decision-making. Total resource planning organizes information on a variety of resources into a form capable of being used to resolve alternative choices (Aten 1982). Planning for the cultural resources of a refuge, one part of comprehensive refuge planning, involves identifying and organizing the diverse information on the Service's cultural resources and establishing priorities for the identification, evaluation, and protection of these resources.

Cultural resource planning has been given, of late, considerable attention by various individuals and government agencies (e.g., Aten 1982; Knoerl 1982; Heritage Conservation and Recreation Service 1980; Department of the Interior 1983). The old emphasis on the indiscriminate accumulation of more and more data (i.e, on surveying all properties, identifying all sites, and evaluating all sites) has been discarded, with new approaches to cultural resource planning emphasizing the use and organization of existing information, the selective acquisition of new information in response to important data gaps, and the protection of significant resources according to set priorities (Aten 1982). The new approaches identify several steps basic to the planning process. These steps, represented schematically in Figure 18, are explained below.

> Collection and Organization of Data. All practicably obtainable information on the known cultural resources in the study area, regardless of how much or how little that may be, should be collected and organized. If applicable, data should also be collected on constituent groups (e.g., local archeological societies, university groups) that may later play important roles in protecting the resources.
>
> Critical Examination of the Data. The data collected should be critically examined to identify data gaps and possible biases that need to be checked and corrected. Data should also be collected on threats to the integrity of the resources (e.g., the threat of erosion, vandalism, or development), and should be stated objectively in a fashion usable by administrators and decision-makers (Aten 1982).
>
> Formulation of Preservation Plans. Following examination of the data, preservation plans for the identification, evaluation, and protection of cultural resources should be formulated. Strategies for filling in data gaps and correcting biases, through archival research, on-the-ground survey, or site evaluation, should be specified (U.S Department of the Interior 1983). Based on probable site significance and the degree of threat, priorities for the protection of significant resources through the mitigation of adverse effects should be established.

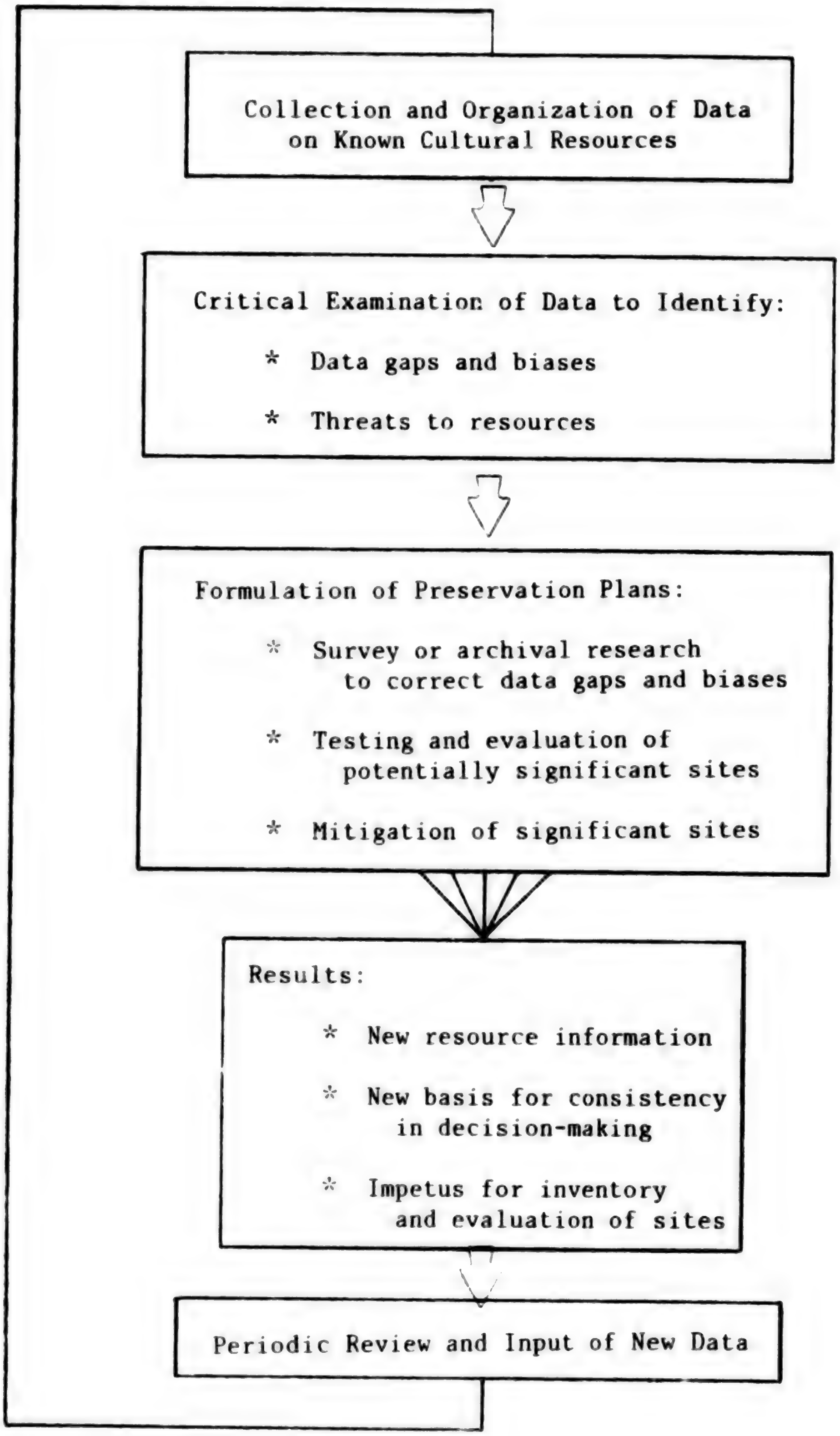
Collection and Organization of Data on Known Cultural Resources
Critical Examination of Data to Identify:
* Data gaps and biases
* Threats to resources
Formulation of Preservation Plans:
* Survey or archival research to correct data gaps and biases
* Testing and evaluation of potentially significant sites
* Mitigation of significant sites
Results:
* New resource information
* New basis for consistency in decision-making
* Impetus for inventory and evaluation of sites
Periodic Review and Input of New Data

Figure 17. Model of cultural resource planning process. (Adapted from Aten 1982)

> Periodic Review. As archeological investigations specified in the preservation plan are carried out, the accumulated information is cycled back into the planning process. From this, the old preservation plan is refined, and requirements for future work are revised to reflect the new knowledge.

The plans and strategies formulated in the planning process may initially be less than ideal, but once set up they can gradually be refined (Heritage Conservation and Recreation Service 1980). Planning theory stresses that the implementation of the planning process, even in a generalized way, is far more effective in the long-run than intensive efforts expended piecemeal outside of the process. Institutionalizing cultural resource planning assures continued concern for cultural resources and allows continuity in decision-making (Aten 1982). By incorporating cultural resource planning into comprehensive planning, cultural resources are given the same level of management consideration as is accorded natural and other resources.

Making cultural resource planning part of the larger planning process of the Fish and Wildlife Service can be accomplished several ways. In the refuge system, planning documents range from comprehensive master plans to smaller, single-resource management plans. In the past, master plans, which ranged from book-sized reports to "one-sheet master plans," rarely examined cultural resources. In contrast, the master plans slated to be drawn up for approximately a half dozen refuges in the Southeast in the next several years will be produced according to the guidelines in the NWRS Planning Workbook (U.S. Fish and Wildlife Service 1980). The inclusion of cultural resources into these master plans is potentially of the utmost importance, since delegation of funds may be contingent on the priorities they establish (U.S. Fish and Wildlife Service 1983). As new master plans are developed for refuges in the Southeastern Region, a cultural resources section, developed in close consultation with the Service's Regional Historic Preservation Officer, should be included.

Decision-making on refuges without master plans is based on a collection of management plans, each dealing with a different resource (e.g., Cropland Management Plans, Public Use Management Plans, Water Use Management Plans). Cultural Resource Management Plans (CRMPs) should be drawn up for refuges lacking a master plan. The CRMP may vary in detail depending on priorities set individually for each refuge, and on the archeological sensitivity of the area (U.S. Fish and Wildlife Service 1983).

## Inventory, Evaluation, and Treatment of Significant Cultural Resources

As an integral part of the planning process, a program of inventory, evaluation, and treatment of significant cultural resources should be initiated for the Southeastern Region. On Federal lands, inventory, which involves field survey of an area by a qualified professional to locate and identify archeological sites, is legally mandated by the National Historic Preservation Act of 1966, as amended, and Executive Order 11593, "Protection and Enhancement of the Cultural Environment." For the Fish and Wildlife Service, reconnaissance field survey is called for both in the Refuge Manual (5 RM.16) and in the Interpretation and Recreation Program Management Document. Field survey is both a research tool and a management tool, in that it provides information on the types, numbers, and distribution of archeological properties within a specified area. Inventory allows the Service to know what resources are on a property, and thus plan for their protection. In coastal areas, inventory is needed to locate and identify archeological sites before they are damaged or destroyed by erosion so that protection or documentation of the sites can be initiated.

In the past, survey on the refuges has been largely construction-related rather than structured for comprehensive inventory. For the coastal refuges in the Southeastern Region, all of the archeological investigations sponsored by Fish and Wildlife in the last five years were directly prompted by proposed construction projects. Such construction-related surveys generally concentrate on portions of the refuge slated for immediate impact, and do not systematically examine other areas. In the future, the Service needs to make systematic, refuge-wide archeological survey an integral part of their planning.

Evaluating the relative significance of sites is perhaps the most difficult of archeological tasks. Significance evaluations are important, however, in that sites considered significant are to be preserved or "banked" for future investigation, or, if threatened by impending impact, subjected to a program of data recovery (Simonsen 1979:56-60). In contrast, sites considered to be of little or no value are considered expendable. However, the criteria for determining that a particular site is to be declared surplus must be equally as rigid and rational as the criteria used to determine which sites are significant (Simonsen 1979:41,69).

There is no single, universal scheme for evaluating significance that is agreed upon among archeologists (Simonsen 1979:56), yet it is generally accepted that determinations of significance should be based on a site's integrity, uniqueness, exceptional quality, diversity of potential data, or other characteristics of significance. In the case of prehistoric archeological sites, a site's potential to yield important information to prehistory is usually critical. Evaluations of significance should be made in context of professional regional research designs, when available, and should always take into consideration known archeological resources in the area.

In some cases, significance evaluations can be made on the basis of known information or on archival research. For most sites, evaluating significance requires additional field work in the form of test excavations. Test excavations generally involve controlled recovery and examination of sub-surface deposits, and seek to define the nature and extent of archeological materials (Simonsen 1979:38). Methodologically, test excavations are no different from large-scale excavations, but they differ in their goals and objectives (Simonsen 1979:38). Testing seeks to provide information on a site's chronological position, state of preservation of artifactual and non-artifactual materials (e.g., plant and faunal remains), which in turn forms the basis of determining significance.

Evaluation of a site as significant should, in most cases, be accompanied by nomination of the site to the National Register of Historic Places. However, the National Register is undergoing major changes, with emphasis shifting to State and agency involvement in significance determinations. Until these changes are accomplished, action on nominations may be delayed. Important to remember, though, is that until a site recommended as eligible is evaluated, it must be afforded the same degree of protection by the Service as is given eligible sites (U.S. Fish and Wildlife Service 1982:5 RM 16.12).

Treatment, the final phase in a management plan, is any action taken to mitigate adverse effects on archeological properties. The two basic treatment alternatives for significant sites are preservation-in-place and data recovery. In the case of coastal sites, the preservation-in-place option is equivalent to the use of erosion control measures, and often involves data recovery in conjuction with it.

Preservation-in-Place. In situations where preservation is possible, preservation is clearly the preferred goal for both archeologists and resource managers, since it preserves the site for consideration at some future date when the information it contains can be used to address new problems in prehistory (Gramann 1982; Glassow 1977; U.S. Department of the Interior 1983). Protection of archeological sites in coastal areas, however, is not always a viable option. The complex nature of erosional forces, the constant wearing away of the land surfaces by waves and tides, and the possibility of severe impact from intensive storm activity make preservation of some coastal sites impractical. Still, erosion control measures have proven effective in protecting some non-archeological coastal properties, at least temporarily. Protection for certain archeological sites in the coastal zone may be feasible, and if so, preservation-in-place, through the use of erosion control measures, should be given primary consideration as a measure to mitigate the loss of prehistoric resources (Simonsen 1979:42). The major considerations in deciding what treatment alternative to use are based on archeological, engineering, environmental, and monetary factors.

The archeological significance and research value of the site in relation to other, similar sites is an important factor in deciding which treatment alternative to use. If the site has aspects that make it unique to a particular region, or if a site is of a type fairly well studied by present research standards, then preservation may be the optimal treatment. If, on the other hand, a site may yield basic chronological data and is in an area so little known archeologically that even basic research questions have not been answered, then data recovery may be the preferred alternative. Ideally, preservation efforts would result in the safekeeping of a representative sample of sites.

Whether preservation or data recovery is preferred will also depend on the possible adverse effects to a site caused by preservation measures. Immediate adverse effects can include the destruction of part of a site during construction of an erosion control structure, or disturbance to site integrity by the use of heavy equipment or by the planting of vegetation. Possible long-term disturbances of physical protection are less well known. Heavy riprap may damage a site by compacting the soil, while highly visible protection devices may draw attention to a site, making it more attractive to pothunters and more vulnerable to destruction by vandalism. Chemical fertilizers, used to promote vegetation growth, may destroy osteological material or palynological data in the site matrix. While research has been conducted on the effects of freshwater inundation on archeological sites (e.g,. Lenihan et al. 1981), no similar work has been done for coastal archeological sites.

Once archeological criteria have been considered and preservation has been determined the preferred alternative, the engineering feasibility of erosion control measures must be assessed. This assessment can only be made on a site-specific basis, since erosion control measures are specialty design items. Characteristics of a site, such as site size, foundation conditions, exposure to wave action, water depth, wave height, wave periodicity, and fetch length determine the selection of erosion control measures and details of design geometry. A structure that depends on penetration for stability is not suitable for a rock bottom, while random stone or some other flexible structure using a filter layer could be used on a soft bottom. Similarly, erosion control measures must be compatible with the configuration of the shoreline. Bulkheads and seawalls, well-suited for bluff shorelines, are inappropriate for low, sloping beaches, while the opposite is true of revetments. In marshes, no structural controls should be used, and vegetation is the only appropriate protection measure (U.S. Army Corps of Engineers 1981). Site accessibility is also a factor in structure choice, since many sites in the refuge system are accessible only by boat and cannot practically be reached with the heavy equipment needed to implace some control works.

Erosion control measures must also be compatible with environmental features such as climate and salinity. For example, warm salt water corrodes metals more easily than cold water, and is the habitat of marine borers that can damage submerged timber structures. A control measure may also accelerate erosion in nearby areas or have a detrimental effect on the nearby marine ecology.

Treatment for damage by natural forces should strive to be cost-effective. Cost-analysis of shore protection must take into account the initial cost of design and construction and the long-term costs. Initial costs can only be calculated on a site-specific basis once a particular control measure has been selected, and depend on design specifications, local labor costs, local availability of construction materials, and other variable factors. The base price for most structural measures ranges from $50 to $1,000 per linear foot, and as design specifications become more stringent, costs increase astronomically. Vegetation is far less expensive than alternative structural devices, with the principal cost being the labor involved in planting. Generally, marsh plantings range from $5 to $10 per linear foot for a 30 foot swath (Knutson and Inskeep 1982). Finally, if the measure will involve destruction of part of a site, the cost of associated data recovery must be included as part of the initial cost.

Long-term costs, more difficult to calculate, are largely a product of the economic life-span of the structure, an obvious "unknown" in coastal areas. Long-term costs also include the annual cost of maintenance and repair of a structure, and eventual replacement or data recovery when the measure loses its effectiveness.

Finally, the use of physical erosion control measures to protect archeological sites in littoral areas is still in the experimental stage. Much research has been conducted on erosion control measures for the protection of non-archeological properties, and this research should be adaptable to archeological situations. The Service should make a strong effort to experiment with preservation measures. In doing so, the Service should consider acting in tandem with other Federal agencies (e.g., the Corps of Engineers, the National Park Service) to develop effective and cost-efficient measures of archeological site protection. When provided to other Federal agencies, documentation of the Service's experiments with shoreline protection, both in the initial construction phase and over a period of time, would be a beneficial contribution to archeological conservation studies.

Data Recovery. When a significant site is threatened by erosion, data recovery to retrieve important information will often be the only feasible means of treatment. Data recovery, though not inexpensive, will in some cases be more cost-effective than preservation-in-place, since data recovery does not require the indefinite commitment to maintenance that preservation entails. For coastal areas where storms often defy even well-designed attempts at site protection, data recovery insures that significant information will be recovered and permanently preserved in curational facilities and in scholarly reports.

As with preservation, the decision to excavate a site must be based primarily on the archeological significance and research value of the site and its relation to other similar sites. Once data recovery has been selected as the best treatment alternative, an effort must be made to see that all pertinent data are recovered during the excavation. Plant and animal remains, which in coastal sites are usually particularly well preserved, can provide valuable information on man's use of his environment, his past economic activities, diet, population size, and seasonality of site occupation (Coastal Environments 1977). Human osteological data, when present, can be used to address questions on mortuary practices, genetic traits, demography, nutrition, health, and status. In addition to addressing these essentially anthropological questions, the data in coastal middens may provide information important to the study of paleoecology, paleoclimate, and geomorphology if appropriate interdisciplinary research designs are employed.

To adequately mitigate the adverse effects of erosion, data recovery programs for eroding sites must include limited testing of the back portion of the site. Normally, more intensive excavation of the threatened, seaward edge of the site is called for, but excavation of this portion alone may introduce interpretive biases (Sanger 1980:4,13). To eliminate potential bias, to provide comparative data critical to the understanding of overall site patterns, and to aid in preservation planning for the remaining portions of the site, controlled stratigraphic excavations of undisturbed portions of the site are needed (Sanger 1980; Huston and Stoutamire 1982:iv,99).

Data recovery programs vary widely in scope and costs, depending on the nature of the individual site and the real-world constraints. Midden sites, which comprise the majority of eroding sites on the coastal refuges, are the most difficult type of site for which to provide reasonable cost estimates. With respect to costs, actual field work is only a small part of the overall expense. Following this, special analyses such as pollen analysis, zooarcheological work, artifact analysis, and radiocarbon dating are required, followed by report preparation. Curation of the recovered material is a final expense that must be factored into the cost. Thus, even the simplest data recovery project on a small midden may cost $10,000. This cost can easily increase ten or twenty fold as site size and site complexity increase. Thus, the cost effectiveness of data recovery versus site preservation, like other factors in the treatment decision, must be analyzed on a site-specific basis.

## Summary

This study has, it is hoped, focused attention on the destructive effects of coastal erosion to archeological sites on the wildlife refuges and, to some degree, on the southeastern coast as a whole. The study has provided a framework for coastal prehistory and a background for the understanding of present-day erosional processes. Previously scattered information on the archeological resources within the coastal refuges has been gathered. Treatment alternatives for dealing with eroding sites have been presented, and potentially useful erosion control measures discussed. Through this, the report has provided a basis for the Service to develop a unified management policy for eroding sites. The tremendous loss of coastal archeological data in the past, together with the present-day rate of archeological site attrition, makes for a situation that demands the attention of archeologists and resources managers.

In hindsight, inclusion of historic as well as prehistoric cultural resources would have made for a more complete overview of the cultural resources in the refuge system, but the decision was made early in the study to focus exclusively on prehistoric resources. Fish and Wildlife has many significant historic properties on their refuges, and systematic planning for their protection is needed.

The following is a summary of the major recommendations resulting from this study:

- Develop a method of evaluating the relative significance of prehistoric resources.

- Initiate a program of systematic survey of coastal refuges based on the priorities established in this study.

- Initiate a program of testing and evaluation of potentially significant sites based on the priorities set in this study.

- Experiment with erosion control techniques as a site preservation measure.

- Inventory historic properties on refuges, identify the potential threats to these resources, and set priorities for their protection.

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# APPENDIX A

## KNOWN PREHISTORIC RESOURCES IN COASTAL WILDLIFE REFUGES, SOUTHEASTERN REGION

Appendix A summarizes the known prehistoric cultural resources for each refuge, provides estimates of the potential for significant prehistoric resources, and points to priorities for future archeological work in the refuge system.

The data are in large part synopsized from survey reports funded by the Fish and Wildlife Service. The State Historic Preservation Offices provided additional site information, and for some refuges made assessments of archeological potential. Only Federally sponsored surveys and testing programs are listed under the survey heading. While prehistoric archeological resources form the primary component of the appendix material, occasional mention is made of known historic resources on the refuges.

At the end of Appendix A, information on the five wildlife refuges in Puerto Rico and the Virgin Islands is presented. Although outside of the continental United States, these refuges are managed by the Southeastern Region of the U.S. Fish and Wildlife Service, and the information should be useful for future planning.

TABLE 1
Known Prehistoric Resources in
Coastal Wildlife Refuges, Southeastern Region

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Pea Island | Dare Co., NC | Thompson and Gardner (1979) | 0 | 0 | 0 | low |

Pea Island Refuge, which falls within the boundaries of the Cape Hatteras National Seashore, is in an environment of constant change. Part of the Outer Banks, the entire island is migrating landward while being traversed north to south by the opening and closing of inlets (Godfrey and Godfrey 1976; Dolan 1971). Erosion rates on the seaward side of the island averaged 8.7 ft./yr. from 1958 to 1969, with a maximum of 20.7 ft./yr., and have increased since that time (Vincent and Dolan 1971).

In a cultural resource survey of the refuge, Thompson and Gardner (1979) conducted archival work for the entire refuge and field reconnaissance of three proposed impact areas. No sites were located, and neither the background research nor the field reconnaissance gave any indication that the refuge area had been occupied prehistorically. No further survey regarding prehistoric cultural resources is needed. However, Thompson and Gardner recommended that the refuge staff undertake further archival research on the nature and history of the Pea Island Lifesaving Station, which for a number of years was the only Black American lifeboat station in the U.S. Coast Guard.

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Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Swanquarter | Hyde Co., NC | Thomas (1980) | 0 | 0 | 0 | high |

Although there are no known sites for Swanquarter, there are several prehistoric sites known for the immediate vicinity of the refuge, and the archeological potential of the refuge is high. Specifically, the area is likely to have been utilized by local inhabitants during the Archaic and Woodland periods for hunting, fishing, shellfishing, and water fowling (Thomas 1980).

Thomas' (1980) survey was restricted to two small project areas, both low site potential areas of land fill over tidal marsh. A preliminary predictive model suggests the following areas as particularly sensitive to cultural resources: the bank and elevated areas of Alligator Gut, the upper reaches and less marshy parts of Rose Bay Creek, the shoreline southeast of the refuge headquarters where dry land comes near the shore of Rose Bay, Great Island, and other former landings. These areas would require intensive survey before any impacts occur. A reconnaissance survey of the refuge to locate prehistoric resources is suggested as a second priority.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Cedar Island | Carteret Co., NC | Anthony and Drucker (1981) | 7 | 0 | CI-4 | high |

Anthony and Drucker's (1981) survey was project-specific, and covered 6 linear miles and 24 acres out of a total area of 13,526 acres. All marsh areas were excluded from the survey, and the only portion of the shoreline surveyed was between Cedar Inlet Point and Green Point on Lewis Creek. The survey resulted in the location of three prehistoric sites. Four additional sites are recorded for the refuge in the N.C. Department of Cultural Resources' site files. Of the sites located by Anthony and Drucker, two were recommended ineligible to the National Register due to extensive prior disturbance. The third, the Green Point midden (CI-4), was considered potentially eligible to the National Register for the data it may yield on Middle and Late Woodland coastal adaptations, although the portion in the proposed impact area was determined an ineligible site remnant. CI-4 is eroding into Core Sound, and artifacts, including human skeletal material from the site and several smaller middens, have been reported exposed along the coastline. Intensive testing of CI-4 to determine site significance will be needed if refuge development threatens to impact the site. Until then, monitoring of the site is recommended. Reconnaissance survey of unexamined portions of the refuge is recommended, and marsh areas west of Highway 12 should be checked for buried sites if development is proposed.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recom-mended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Cape Romain | Charleston Co., SC | Wright (1978)<br>Anderson and Claggett (1979) | 11 | 0 | 38 Ch 40 | high |

Wright's survey (1978) was project-specific, examining only two areas of the refuge--Bull's Island and Moore's Landing. Following Wright's recommendations, two sites were subject to an ar heological testing program (Anderson and Claggett 1979). Of the sites tested, the Moore's Landing site (38 Ch 184) had a shallow Mississippian period shell midden, but the deposits had been heavily disturbed and the site did not warrant placement on the National Register. On Bull's Island, a second site (38 Ch 292) was a secondarily deposited shell concentration, the result of dredgework, and was not considered significant. A third site, the Andersonville or Awendaw Mound (38 Ch 9), a largely destroyed Late Archaic through Mississippian period midden, was located a mile northeast of the refuge boundaries and thus was not subject to further examination. As part of their investigations, Anderson and Claggett also resolved locational ambiguities for the Cedar Grove or Indian Kitchens Midden Mound site (38 Ch 40), for which a National Register nomination has been prepared. The site is damaged on the west side by a road cut, but otherwise is in excellent condition. A field check of the site to verify its present condition is recommended.

Site data on the rest of the refuge are confused and inaccurate. Wright (1978:18) lists 33 prehistoric sites for the Cape Romain Refuge, but only 11 of these fall within the refuge boundaries when plotted on a map. Several shell middens are located along the Harbor River, and a field check of the sites is recommended, followed if necessary by testing and evaluation. The Francis Marion National Forest shares a common boundary with the refuge along the Harbor River, and coordination between the U.S. Forest Service and the Fish and Wildlife Service is suggested.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recom-mended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Pinckney Island | Beaufort Co., SC | Lepionka (1979)<br>Drucker and Anthony (1980)<br>Braley (1982a)<br>Charles (1983) | 89 | 38 Bu 67 | 38 Bu 66 (District) | high |

Pinckney Island has been the subject of extensive survey in the past, and it is likely that all potentially significant cultural resources have been located. In addition to the surveys noted above, additional work on the refuge has been conducted by the Institute of Archeology and Anthropology at the University of South Carolina (Michie 1980), and the South Carolina Department of Highways (Trinkley 1981). The refuge has high potential for yielding significant data for the study of changes in human adaptation to and utilization of estuarine and tidal zone resources along the South Carolina coast, and Braley (1982a) proposed that the entire refuge be nominated as a National Register district. As Braley noted, the establishment of a National Register district should not be incompatible with refuge development plans. Most of the interior sites have already been disturbed by plowing, and efforts to return the island to a more natural state by efforts such as tree planting would not likely have significant adverse effects.

The most serious threat to the cultural resources on Pinckney Island is coastal erosion, as the island is surrounded by linear shell middens that are slowly being eroded by tidal action. Charles (1983) conducted test excavations at three eroding shell middens (38 Bu 167, 38 Bu 166, and 38 Bu 66) located at Last End Point on the southernmost tip of Pinckney. 38 Bu 167 and 38 Bu 166 were recommended ineligible to the National Register, while 38 Bu 66, a multi-component late prehistoric, and proto-historic, and/or historic contact period site was recommended as

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eligible to the National Register. The site may be significant to the interpretation of prehistory on the local and regional level, and to the interpretation of history on the national level. If the Altamaha component at Last End Point proves contemporaneous with the Spanish occupation at Santa Elena, the site could contribute substantially to the understanding of the cultural dynamics of contact situations, specifically at the onset of European-Indian cultural interaction in the United States (Charles 1983). The site is currently undergoing a direct adverse impact from erosion. There is an extremely high rate of erosion along Skull Creek, but the rate of destruction is particularly acute at the confluence of Skull and Mackay creeks in the vicinity of the most significant component, the proto-historic component. Erosion on the point is reported at 1 foot per year, and comparisons of 1978 aerial photographs with the current erosion bluff line bear this out (Charles 1983). The Service should initiate a monitoring program to verify the rate of destruction and consider treatment alternatives if warranted.

In conjunction with plans for 38 Bu 66, a resource management plan for Pinckney should make provisions for the monitoring and/or testing of the other potentially significant middens that surround the island. Braley (1982a:104) notes that although the middens are not spectacular, the data they contain are important to the study of settlement and subsistence patterns in the Sea Islands. Primarily because of the sites' wide areal extent, large-scale preservation measures would not be feasible or prudent, although protection of small sectors may be. Braley (1982a:109) pinpointed 20 sites as undergoing particularly severe erosional damage (this included three sites since tested by Charles), and these should receive first priority in any testing program.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recom-mended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Savannah | Jasper Co., SC<br>Chatham Co., GA | Marrinan (1979)<br>Lepionka et al. (1983) | 20 | 38 Ja 61 | (District) | high |

Erosion problems on the Savannah Refuge are related both to dredging and diking of managed water impoundments and to tidal action along the Back River. The type site for the Refuge phase (38 Ja 5) is located in the Savannah Refuge, and was reported as badly eroded at the time of its excavation by Waring in 1947; in 1960 Waring reported that the site had almost completely disappeared (Williams 1968:198). Marrinan (1979), who considers the site critical in clarifying the position of the Refuge ceramic phase, made a surface collection of the site and noted the continued erosion of the midden into the Back River. Testing and evaluation of the site to see if sufficient integrity remains for National Register eligibility is recommended.

Marrinan's (1979) survey concentrated on island hammocks and water impoundment dikes. At the time of the survey much of the land was submerged; survey of these areas, together with Onslow, Isla, and Argyle Island is suggested, but is of low priority when compared to the evaluation of 38 Ja 5 or when placed in context of the entire refuge system.

Following Marrinan's survey, 38 Ja 61, also known as Site 22 or the Second Refuge site, was determined eligible to the National Register. To mitigate adverse impacts, a data recovery program was carried out at the site by Lepionka et al. (1983). To avoid impact at a second potentially eligible site (SNWR #4), Fish and Wildlife rerouted a levee to bypass the site. A third site, Mocassin Island (SNWR #26), which was originally recommended for additional archeological work, was later determined not eligible for listing on the National Register (Memorandum, FWS, 1980).

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recom-mended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Tybee | Chatham Co., GA | -- | 0 | 0 | 0 | low |

Tybee Refuge is comprised of a 100 acre marsh island at the mouth of the Savannah River. The island is known as Oysterbed Island, and is 75 percent covered with spoil deposited from the U.S. Army Corps of Engineers' dredging activities. There are no known archeological sites on the island, and the archeological potential of the refuge is considered minimal. No archeological work is recommended.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Wassaw | Chatham Co., GA | DePratter (1977)<br>Pearson and Pearson (1978) | 61 | 0 | (District) | high |

DePratter's (1977) survey, conducted under an Antiquities Act Permit, covered most of the small hammocks on the east of Wassaw Island and located 56 prehistoric sites. Pearson and Pearson's (1978) survey was project-specific (ca. 30 miles of foot trails and roads and 25 acres of support facilities), and located five prehistoric sites. All known archeological sites are located in the older, western section of the refuge. Survey of the refuge is nearly complete, with only a few hammocks in the western portion of the refuge and parts of the western section of the main island not having been surveyed.

Although not enough data exist for a National Register nomination at this time, the prehistoric sites on Wassaw Refuge are considered important for their potential to supply unique information on the coastal geomorphology and coastal adaptations of the area. A number of sites were originally recorded as eroding into tidal creeks, and their present condition is unknown. Further extensive survey of the refuge is not recommended, but known sites should be field checked to determine their present condition. Most of the sites are small, and for these a maximum of four days would be needed to test any one (Pearson and Pearson 1978). Future research should concentrate on testing and gathering settlement and subsistence data from known sites (Pearson and Pearson 1978).

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Harris Neck | McIntosh Co., GA | Fryman, Griffin and Miller (1979)<br>Drucker (1982a)<br>Drucker (1982b) | 6 | 9 McI 41 | 0 | high |

The survey by Fryman, Griffin and Miller (1979) found evidence for aboriginal use of the Harris Neck Refuge from A.D. 500 to Contact times. The survey was intensive, covering a major portion of the 2,687 acre refuge, and it is likely that most of the resources on the refuge have been discovered. The concentration of sites is in the eastern portion of the refuge, where 9 McI 41, a site determined eligible for the National Register, is located. Erosion has had a severe impact on 9 McI 41, causing a major portion of the site to fall into Barbour River. A portion of 9 McI 41 located in a proposed road realignment was subject to a program of testing and evaluation by Drucker (1982a). Following this investigation, the Advisory Council on Historic Preservation determined that no further work was neeeded in the proposed construction area (Drucker 1982a: Appendix F). A separate survey by Drucker (1982b) showed that the area known as the Bertram Fish Camp Property was a site remnant of 9 McI 41, and was ineligible for the Register due to its alteration by erosion and other disturbance (Drucker 1982b). No further reconnaissance survey for prehistoric cultural remains is required, but limited testing may be needed to determine impacts if new construction projects are proposed. Testing is also suggested for potentially significant historic resources, such as the tabby ruin at Thomas Landing and the Black community of Harris Neck.

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Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Blackbeard Island | McIntosh Co., GA | DePratter (1977)<br>Marrinan (1980) | 39 | 0 | (District) | high |

DePratter's (1977) survey, which located 33 sites, showed that the eastern half of the refuge is geologically very young, having been formed after A.D. 450. Marrinan's (1980) survey, covering 5 linear miles of existing or proposed dikes and ditches and spot-checks of proposed impact areas, located six additional sites. Most of the sites are on the western half of the refuge, where both Marrinan and DePratter noted considerable erosion of sites along Blackbeard Creek. Potentially significant sites are also located on the northern part of the refuge where they could be damaged by cleaning of the face ditches in the water impoundments.

Marrinan suggested that all the sites on the refuge are potentially eligible to the National Register based on the information they may yield pertinent to questions of coastal chronology, coastal adaptations, site variability, and inter-island comparisons of cultural development. At this time, however, there is probably not sufficient evidence to support a district nomination. More systematic survey of the refuge is recommended, to include intensive survey, testing, or monitoring of the sites along Blackbeard Creek.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recom-mended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Wolf Island | McIntosh Co., GA | -- | 0 | 0 | 0 | low |

Wolf Island Refuge, which is 75 percent salt marsh, has no known sites and minimal archeological site potential. Survey of the refuge is not recommended.

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Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Merritt Island | Brevard and Volusia Co., FL | Griffin and Miller (1978) | 39 | 8 Vo 130<br>8 Vo 131 | 0 | high |

The 140,000 acre Merritt Island Refuge shares property boundaries with the John F. Kennedy Space Center and the Canaveral National Seashore. An Interagency Agreement concerning the Merritt Island Refuge and the Canaveral National Seashore (U.S. Department of the Interior 1981) states that research and interpretation of archeological sites within the area jointly managed by the Park Service and the Fish and Wildlife Service, i.e., that area south of the Gomez Grant line and north of the railroad, will be the primary responsibility of the Park Service, although any site protection or development will be fully coordinated with Fish and Wildlife. Maps in the regional office indicate that only a small area of land near the Refuge Headquarters is under the primary responsibility of the Fish and Wildlife Service. Maps provided by the State Historic Preservation Office show that this parcel contains only one site (8 Br 159), a prehistoric lithic and ceramic scatter.

The survey by Griffin and Miller (1978), funded by the Fish and Wildlife Service, was was project-specfic and included systematic survey and intensive testing of proposed fire lanes, 14 spot checks in areas of proposed water management construction, 11 spot checks in proposed I & R development areas, and surface survey of 26 miles of existing dikes. Other surveys of the Refuge/Seashore have been conducted under the sponsorship of the Park Service (e.g., Long 1973; Smith 1973; Ehrenhard 1976).

The Ross Hammock Site, listed on the National Register, falls within the Refuge-Seashore boundaries. The site has both a historic component (a Confederate saltworks) and a prehistoric component with a St. Johns village midden (8 Vo 130) and two burial mounds (8 Vo 131). Other potentially significant sites in the Refuge/Seashore include Turtle Mound, Cat Hammock, and the Castle Windy Midden. Previous test excavations at Ross Hammock and other sites have yielded information on mound structure, while future excavation could yield valuable information on the "zone of transition" between the Belle Glades and St. Johns culture areas, past environmental conditions, and a wide variety of other research questions.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Pelican Island | Indian River Co., FL | Rudolf and Braley (1981)<br>Campbell, Thomas, and Weed (1982) | 3 | 0 | 8 Ir 49<br>8 Ir 50 | high |

Rudolf and Braley (1981) surveyed 37 acres in a proposed construction area. Three sites were located. Two sites in the impact area were tested (Campbell et al. 1982), revealing two intact shell middens. One midden (8 Ir 49) was dated between A.D. 820-1130, while a second midden lens (8 Ir 50) was dated ca. A.D. 1340. The sites are in citrus groves on slight rises next to the Indian River. The edges of both sites have been cut by mosquito control ditches, but the sites are not otherwise endangered and are in good condition. Both sites were suggested as eligible to the National Register, and nomination forms were completed. Avoidance of the sites during construction is recommended, but if that is not possible data recovery will be necessary. 8 Ir 51, the third shell midden site, should be tested for eligibility if it becomes threatened by impact.

A preliminary site prediction model by Rudolph and Braley (1981) indicates that there are no other high probability areas in the refuge. No further reconnaissance survey is recommended.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recom-mended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Hobe Sound | Martin Co., FL | Fryman, Swindell, and Miller (1980) | 1 | 0 | 8 Mt 13 | high |

The Joseph Reed Mound (8 Mt 13), the only known site in the refuge, has the appearance of a Late Archaic shell ring, although it may be the remnant of a dike built in the nineteenth century to protect a citrus grove (Fryman et al. 1980). Half of the site has already been lost to erosion, and the site is continuing to erode at an average rate of 15 feet per year. Because the site is potentially significant, a testing program to determine its origin and its eligibility to the National Register is recommended. The recommendation for test excavation made by Fryman, Swindell, and Miller (1980), and by Dr. William Sears of Florida Atlantic University, has the concurrence of the Florida State Historic Preservation Officer (Morrell 1980).

The survey conducted by Fryman et al. (1980), which included field survey of two 10 acre tracts and a walkover of all high probability areas, discovered no new sites. Further survey on the refuge is of low priority, and when conducted should rely on subsurface testing within mangrove and shoreline zones and reexamination of previous site distribution models (Fryman et al. 1980:46).

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Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Crocodile Lake | Monroe Co., FL | -- | 1 | 0 | 0 | high |

One prehistoric site (8 Mo 25) is reported for the refuge. The site is a black earth midden dating to the Glades III period and was originally recorded by Goggin in 1940. By 1956, very little of the site remained (Florida Master Site File). For the rest of the refuge, site potential along the edges of the mangrove wetlands and on the marsh hammocks is of medium to high site potential (Percy 1982). A reconnaissance survey of the refuge to locate new site and to check the condition of 8 Mo 25 is recommended.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| National Key Deer | Monroe Co., FL | Griffin, Fryman, Miller (1979) | 4 | 0 | 0 | high |

Survey by Griffin et al. (1979) of the National Key Deer Refuge involved systematic survey of six proposed impact areas. The only prehistoric site recorded on the Refuge at that time, Watson's Hammock (8 Mo 7), was a black earth and shell midden occupied during the late Glades period (ca. A.D. 500-1000). Even though the site has been heavily disturbed by borrowing, it is still considered likely to have sufficient integrity to yield information important in prehistory and to be eligible for inclusion on the National Register. Three other sites have been recorded since the survey by Griffin et al. (1979). One site, 8 Mo 245, is believed to have been the main camp for the Calusa Indians in the Keys (Florida State Master File). Limited testing of potentially significant sites is needed to determine their eligibility to the Register, and should have precedence over further survey.

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Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recom-mended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Great White Heron | Monroe Co., FL | -- | 0 | 0 | 0 | low |
| Key West | | | | | | |

No survey has been conducted on the Great White Heron or the Key West refuges. The northern edge of the Great White Heron Refuge and the keys west of Key West are of low prehistoric site occurrence probability, but have low to moderate probability for shipwreck or shipwreck salvage activities (Percy 1982). Survey on these refuges is of low priority within the refuge system.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| J.N. "Ding" Darling | Lee Co., FL | Kennedy (1978)<br>Thomas, Campbell, and Weed (1982) | 11 | 0 | (District) | high |

The "Ding" Darling Refuge encompasses approximately 5,613 acres (4,700 acres of saline wetlands, 913 acres of uplands). In conjunction with proposed construction and development plans, Kennedy (1978) surveyed the entire upland area and an unspecified portion of wetlands, resulting in the location of two previously unknown sites and revisiting of several of the nine previously recorded sites. In 1982, Thomas et al. conducted a survey of ca. 150 acres slated for impact by pepper tree control projects. This survey resulted in the identification of one additional prehistoric site. This site (NWR #6), which represents a concentration of broken whelk shells similar to other shell midden sites on the island, is considered potentially significant (Thomas et al. 1982:71). The site should not be disturbed, but if this is not possible testing will be required.

The prehistoric sites found thus far on Sanibel Island point to occupation of the island by aboriginal peoples from 300 B.C. to the late historic period, ca. A.D. 1700. The concentration of prehistoric settlement is on the bayside of the island, with no prehistoric sites having been found or expected on the Gulf side. Both Kennedy (1978) and Thomas et al. (1982) suggest that intensive survey of the refuge in the wetlands, and particularly around any bay localities not presently reporting sites, stands a high probability for identifying previously unknown prehistoric occupations. The bayside sites are vulnerable to heavy storm damage, and intensive survey of the refuge in this area is recommended. Regionally, southwest Florida is not well understood and little scientific archeology has been conducted. With the rapid destruction of sites in the area due to development pressures, the sites within the "Ding" Darling refuge and other refuges in the Charlotte Harbor area become particularly important.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Matlacha Pass | Lee Co., FL | -- | 2 | 0 | 0 | moderate |

Matlacha Pass Refuge, composed of a series of small, scattered islands accessible only by boat, has two reported sites. The sites, both low middens, were reported as eroding when they were originally recorded in the 1950s. Their present condition is unknown, although they are probably heavily damaged. Other areas of the refuge have a high probability of site occurrence, and reconnaissance survey of Matlacha Pass, in conjunction with survey of Pine Island and Island Bay refuges, is suggested.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Pine Island | Lee Co., FL | -- | 3 | 0 | 8 Ll 49 | high |

Pine Island Refuge, like Matlacha Pass, is composed of a series of islands accessible only by boat. One of the islands, Patricio Key (8 Ll 49), has at least ten acres of Calusa Indian mounds. No information has been recorded for the site other than locational data. However, the site appears to be in excellent condition (D. Pierce, personal communication 1982), and is likely eligible for listing on the National Register. No information on the other two sites reported for the refuge is available. Reconnaissance survey of the refuge is necessary, as is professional evaluation of 8 Ll 49.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Island Bay | Charlotte Co., FL | -- | 5 | 0 | 8 Ch 38<br>8 Ch 45 | high |

Cash Mound (8 Ch 38), a one to two acre Calusa Indian shell mound site, rises ca. 20 feet above sea level on the west side of Turtle Bay in Charlotte Harbor. Though part of the Cape Haze mainland, accessibility is difficult, and the site is best reached by boat. Illegal borrowing at the site by a commercial oystershell company occurred in the mid 1960s, and the site is currently being damaged by wave action.

The John Quiet Mound (8 CH 45), which also appears to be a significant site, is a tall Calusa period shell mound protected from wave erosion by a buffer zone of mangroves (R. Hight, personal communication 1983). Although occupied by squatters in recent years, the site appears to be in excellent condition (G. Luer, personal communication 1983).

Since both Cash Mound and the John Quiet Mound would likely yield important information, a limited program of testing to determine their significance, followed by nomination to the National Register, if warranted, is recommended. Inventory of the rest of the refuge is also recommended, but is of secondary importance to the testing and nomination of the two mound sites. The sites recorded for the rest of the refuge are on the smaller keys in Turtle Bay and are likely low, badly eroded middens or secondarily redeposited shell concentrations (G. Luer, personal communication 1983).

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Passage Key | Manatee Co., FL | | 0 | 0 | 0 | low |

Passage Key, now little more than a sandbar, was once a much larger barrier island. It was an important navigational landmark to early explorers, the location of early Spanish fishing ranchos, and a haven for Indian refugees in the Seminole War (Dye 1971a, 1971b). In 1921, the island was completely destroyed by a hurricane. The key emerged again, but was washed away in a severe storm in 1956 (Dye 1971c). Because of this geological history, no intact archeological sites are likely to be present on the island (Percy 1982). No archeological investigations have been conducted on the refuge, and none are recommended.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Egmont Key | Hillsborough Co., FL | Grange (1977) | 0 | 0 | 0 | low |

Egmont Key, a small island at the mouth of Tampa Bay, is listed on the National Register as a historic property. The nomination was based primarily on a Spanish-American War period fortification, the Fort Dade site (8 Hi 117), although earlier historic occupations of the island are known. Geologically, the key has been modified in size, with most of the alteration being along the seaward coast. The clearest evidence of this is the near collapse into the sea of the gun battery along the southwest shore, and the presence of large cement foundations, once part of an onshore structure, more than 40 feet out in the Gulf along the western shore (Grange 1977). Destructive tropical storms are frequent in this area of the coast, and hurricanes, such as the 1848 hurricane, are known to have covered the island in several feet of water (Grange 1977). In addition to this erosional damage, heavy tourist, picnic, and fishing use of the island poses a threat to its cultural resources.

In a survey concerned specifically with the prehistoric archeological potential of Egmont Key, Grange (1977) noted that it was likely that the island was visited intermittently by aboriginals for activities such as hunting, turtle egg and bird egg collecting, crabbing, and fishing, since historical accounts of the mid-nineteenth century show that white settlers carried out similar subsistence activities on the island. However, there is a low probability that any relatively permanent habitation or burial mound type archeological sites would be present on Egmont Key due to a combination of physiographic features (Grange 1977:25). Moreover, if sites had been present at one time, it is unlikely that they would have survived the natural processes of destruction or the human modifications of the nineteenth and twentieth centuries.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Pinellas | Pinellas Co., FL | -- | 0 | 0 | 0 | moderate |

Pinellas Refuge, consisting of several islands in Tampa Bay with a total of less than 400 acres, has moderate prehistoric site potential. Since the refuge has not been subject to professional archeological survey, a reconnaissance survey of the refuge is recommended.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Chassahowitzka | Citrus and Hernando Co., FL | Dorian and Stoutamire (1981) | 12 | 0 | 8 He 15<br>8 Ci 147 | high |

Dorian and Stoutamire's survey (1981) was project-specific for three proposed construction areas, and included field check of several previously known sites. Two sites, 8 He 15 (identified in Dorian and Stoutamire's report as 8 He 4) and 8 Ci 147, were suggested as potentially eligible to the Register. 8 He 15, the John's Island site, has stratified ceramic deposits dating to St. Johns and Weeden Island periods, but the site has been severely damaged by erosion (see Williams 1977:261). Currently the site is a privately owned in-holding. 8 Ci 147, a sand mound that has been damaged by a road cut, is managed by the Refuge although the property is not Federally owned. If these sites are acquired and brought under Federal protection, they should be tested and evaluated to determine their eligibility to the National Register.

Systematic survey of the refuge is recommended.

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Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recom-mended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Cedar Keys | Dixie and Levy Co., FL | Dorian and Stoutamire (1981) | 6 | 0 | 0 | moderate |

Located on the delta of the Suwannee River, the Cedar Keys and Lower Suwannee refuges together have a diversity of site types, from shell middens to burial mounds. Dorian and Stoutamire's (1981) work on the Cedar Key Refuge involved the evaluation of a historic site, the Cedar Keys Lighthouse, and a field check of known prehistoric sites. Of the six known sites, five were judged endangered but having insufficient data for evaluation, while one was considered unendangered but of probable National Register status. Further intensive survey of the refuge, in conjunction with survey of the Lower Suwannee and Chassahowitzka refuges, is needed to provide information on the types, numbers, and distribution of archeological properties in the region for management and planning purposes. Testing of selected sites may be necessary to formulate research problems.

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Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| St. Marks | Jefferson, Taylor, and Wakulla Co., FL | Bense (1977)<br>Huston (1981) | 58 | 0 | 8 Wa 137, 145, 172, and 173; (district) | high |

Bense's survey (1977), which located 12 sites, was project-specific, and included an intensive survey of a proposed 10 acre headquarters complex, surface survey of ca. 6 miles of existing and proposed dikes, and ca. 10 spot checks in areas of proposed construction. Bense completed a National Register nomination form for the Mounds Archeological District to contain 12 sites with cultural remains from at least 5000 B.C. to the present. The sites, from Late Archaic to Historic, are concentrated on a former barrier beach, and contain a microcosm of space and time relationships throughout prehistory. Each site may contain sufficient integrity to warrant eligibility to the National Register singularly (Bense 1977), and they likely have the potential to yield information regarding human paleoecology, culture history, and cultural processes.

The investigation by Huston (1981) involved survey of three islands in Stoney Bayou Pool and testing of five sites. Huston recommended further archeological investigations at 8 Wa 172 and 8 Wa 173 to assess their significance. He also recommended as eligible to the National Register two Early to Middle Archaic lithic extractive/working sites (8 Wa 135 and 8 Wa 145), and contends that proposed water level management practices within Stoney Bayou Pool will adversely affect the sites. Huston recommended data recovery at the latter two sites to mitigate the adverse effects of inundation. However, the effects of the water management practices have not been established, and until the National Register eligibility of the sites has been formally established the position of the U.S. Fish and Wildlife Service and the National Park Service is that further excavation at these sites is premature (Baker 1981).

The rest of the approximately 64,000 acre refuge has not been systematically surveyed, though numerous sites are known for the refuge and the area has been the focus of archeological investigations since the time of C.B. Moore. Reconnaissance survey of the refuge should be a long-range goal for the Service.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| St. Vincent | Franklin Co., FL | Miller, Griffin and Fryman (1981)<br>Braley (1982b) | 16 | 0 | 8 Fr 71 | high |

The survey by Miller, Griffin, and Fryman (1981) involved intensive systematic survey of 30 acres and three spot locations, plus systematic survey of 10 miles of existing road. The survey report also incorporated data from a previous archeological survey on the refuge by David S. Phelps in 1970. The prehistoric sites on the island show a regular pattern of site distribution, with all known sites being located along the bay shoreline or on Big Bayou (Miller et al. 1981:50). Since it is likely that most of the sites on the refuge have been identified, no further reconnaissance survey is required.

Archeological testing and evaluation of the Paradise Point site (8 Fr 71), which was eroding into the St. Vincent Sound on the north shore of the island, was carried out by Braley (1982b). The site was shown to have two prehistoric cultural components (ca. A.D. 240 and ca. A.D. 900-1000). The site is considered eligible for the National Register, and it is recommended that steps be taken to mitigate the adverse effects of erosion to the site (Braley 1982b; Letter, Florida State Historic Preservation Office, 1982).

Other sites along the north shore of the island are also being eroded by north winds and long-shore currents that seem to have been intensified by dredging activities to the east of the island. Erosion is quite severe, and will probably destroy many of the sites (W. Husted, personal communication 1983).

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Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Mississippi Sandhill Crane | Jackson Co., MS | Swanson, Altschul, and Campbell (1979) | 0 | 0 | 0 | low |

The survey by Swanson et al. (1979) was project-specific and was concentrated in only two of the five physiographic zones in the refuge. The literature search associated with the survey showed that the area had been shunned as a locus for historic occupation. Archeologically, the region is unknown, and very few prehistoric sites have been reported for the coastal flatwoods. Geologically, the region has been characterized by continual fluctuation of the coastline. After the sea level stabilized ca. 4000 B.P., the amount of habitable land in the refuge was severely reduced. It has been hypothesized that the absence of settlement in the last 4,000 years is likely due to the poorly drained soils that characterize the refuge property (Swanson et al. 1979). Sites dating prior to the sea level stabilization may be buried under later deposits, but subsurface testing to a depth between 80 and 100 centimeters revealed no evidence of sites. Thus, if early sites are present, they do not appear to be located at depths that would be affected by most development projects. No further reconnaissance survey is recommended for the refuge.

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Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Lower Suwannee | Dixie and Levy Co., FL | Dorian and Stoutamire (1981) | 39 | 0 | 8 Di 7<br>8 Lv 42 | high |

Shired Island West (8 Di 7), a large stratified midden of approximately 5 acres, is located in the Lower Suwannee Refuge. The site has one of the most complete assemblages on the Central Gulf Coast of Florida, with evidence of occupation from Archaic through Safety Harbor times. Interior portions of the site have been disturbed by historic occupation, and large portions of the seaward edge have been washed away by erosion. Testing and evaluation of the site is recommended. Because of the site's location at the mouth of Shired Creek and its open exposure on the Gulf, physical site protection is probably not feasible from an engineering or monetary viewpoint (Dorian and Stoutamire 1981:5).

8 Lv 42, the Shell Mound site is the largest existing shell mound on the Central Gulf Coast. It has been heavily disturbed by removal of shell for road construction, but undisturbed portions remain and should be evaluated for potential research significance.

The survey by Dorian and Stoutamire (1981) included field checks of several known sites, but no systematic reconnaissance survey has been conducted in the refuge. Since the area has a large number of known sites and the potential for unknown sites is high, survey is recommended.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Bon Secour | Mobile and Baldwin Co., AL | -- | ca. 34 | 0 | 1 Mb 50 | high |

The Bon Secour Refuge has proposed acquisition boundaries for four units--Little Dauphin Island, Point Clear, Skunk Bayou, and Perdue. A cultural resource survey has been conducted on one unit, and archeological data for the other three units is available in the Alabama State Site Files.

The Little Dauphin Island unit was the subject of a limited survey sponsored by the University of South Alabama (Curren and Stowe 1971). The survey located nine prehistoric sites, and gave evidence for occupation of the island since the Late Archaic. Most of the sites were reported at the time of the survey as severely damaged by erosion or vandalism. One site (1 Mb 50), a Fort Walton period oyster shell midden with post molds and features clearly visible in the sterile sand underlying the shell, was considered potentially significant and was recommended for further excavation. Located on the southern shore of the island, the site was eroding into Little Dauphin Bay when originally recorded in 1971. It is possible that 1 Mb 50 was damaged or destroyed in 1979 by Hurricane Frederic, which caused extensive wave damage in the area. Current site condition should be assessed.

The Perdue unit and the Point Clear unit are both on a mainland spit reaching into Bon Secour Bay. Site file data show 23 sites that appear to be within the refuge boundaries, but a field check is needed to determine the sites' exact locations. The area is archeologically rich, and was visited in the late nineteenth century by C.B. Moore who excavated several burial mounds in the vicinity. The majority of sites are located either on Bon Secour Bay or on Little Lagoon, where erosion may have already caused severe damage. The available data on the sites date to the 1950s, and no

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current site conditions are known. For the proposed Skunk Bayou unit on the mainland, two unnumbered prehistoric sites have been recorded.

The Bon Secour Refuge as a whole possesses a high probability for the occurrence of significant cultural resources, both prehistoric and historic (Oakley 1983). Field survey for the location of new sites and the verification of previously recorded data is recommended.

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Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Delta | Placquemine Parish, LA | Jackson (1979) | 0 | 0 | 0 | low |

The Delta Refuge is situated on the most recent of the Mississippi delta lobes, the Balize subdelta. The sediments on which the refuge rests were not formed until after 1831, and thus would not have been available for human occupation until historic times (Jackson 1979). Since the Delta Refuge has no reported prehistoric sites and none are expected (DeBlieux 1982), no further work on prehistoric resources is required.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Breton | St. Bernard and Placquemine Parish, LA | Jackson (1979) | 0 | 0 | 0 | low |

The overview by Jackson (1979) cited site file data on two sites in the Chandeleur Island chain (16 Sb 23 and 16 Sb 25), both recorded as beach wash deposits in the 1950s. Since the scope of work for Jackson's investigations did not call for field reconnaissance of the Breton Refuge, the sites were not checked, although Jackson recommended revisiting the sites to determine their current condition. It appears from the coordinates listed on the site file forms, however, that both sites would now be submerged below sea level in the Gulf of Mexico. The sites are not presently plotted on the state's quad maps (Oakley 1982b), and Mr. Robert Neuman of the Louisiana State University stated that the entire island chain had been severely damaged in the last hurricane (R. Neuman, personal communication 1983). In light of the low potential for significant resources, survey of the refuge is not recommended.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Shell Keys | Iberia Parish LA | -- | 0 | 0 | 0 | low |

Shell Keys Refuge, consisting of eight acres of shell keys in the Gulf of Mexico, has no known prehistoric sites. The probability for site occurrence is considered minimal (DeBlieux 1982). No further work is recommended.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Lacassine | Cameron Parish LA | Burden et al. (1978) | 7 | 0 | 16 Cm 6 | high |

Six of the seven known prehistoric sites in the refuge are redeposited shell middens and appear ineligible for the National Register. However, the seventh, the Onion Hill site (16 Cm 6), is one of the few primarily in situ middens existing in the Chenier Plain region. The site, dating from the Tchula period to the early Mississippian period, a span of ca. 1,200 years, has been cut through on the southern edge by a pipeline canal and is eroding out of the east bank of Bayou Lacassine. With two-thirds of the known sites in Cameron and Vermillon parishes having been destroyed by natural or human causes, the Onion Hill site becomes particularly important for its potential to yield basic chronological data in this largely unknown region (Burden et al. 1978). It is recommended that the Onion Hill site be tested to determine its eligibility to the National Register. If it is determined to be significant, it should either be excavated before futher erosion occurs or be protected, if feasible, for future study by the construction of a bulkhead or riprap along the bayou.

The 1978 investigation, though project-specific, gave coverage to the most of th areas of the refuge not taken up by the 16,000 acre water impoundment. Further study of the refuge is of secondary importance to the need for testing and evaluation of the Onion Hill site.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recom-mended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Sabine | Cameron Parish LA | Thomas , Campbell, and Montagne (1978) | 9 | 0 | 0 | moderate |

The survey by Thomas et al (1978) involved systematic survey of 90 miles of canal banks and 35 miles of existing and proposed levees. Spot checks were also made in areas to be impacted by minor construction. One prehistoric site, the Clubhouse site, was located during the survey; however, the site may be redeposited fill imported in the 1920s rather than a prehistoric habitation site. Two other sites, noted in Thomas' overview, are shell accumulations located by Kathleen Bird during an examination of aerial photographs; only one of the sites was ground verified due to inaccessibility. Since the time of Thomas' survey, three new sites have been recorded; one previously known site has been given a site number; and an additional site has been noted as omitted in Thomas's report (DeBlieux 1982).

Further survey is not recommended at this time, although it should be remembered that sites may be buried beneath the marsh surface and any dredging in the area should be monitored for the presence of archeological sites.

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Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recom-mended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Green Cay | St. Croix, U.S. Virgin Islands | -- | 1 | 0 | 12AVm1-69 | high |

The Green Cay site (12 AVm1-69) is a potentially significant conch midden eroding out of a cutbank on the southeastern end of Green Cay. Recorded by Weiss and Gladfelter (1975) and visited by Robinson and Vescelius in 1976, the site was recently visited by an archeologist from the Virgin Islands Planning Office. The site, which is exposed in a cutbank approximately 2.5 meters high and extends inland about 20 meters, is a large conch shell midden composed primarily of Strombus sp. shells, but also includes other shells, such as Cittarium pica, ceramic sherds, and charcoal. Although erosion due to wave action is damaging the exposed face of the midden along the shore, the remainder of the site appears to be in excellent condition. The site dates to A.D. 1020, and was most likely a conch-processing site of intensive and long-term use (Adams 1982). The size of the midden, its location, unique use characteristics, and apparently high integrity contribute to its probable significance. The site should be tested for National Register eligibility and an interim management plan instituted for those sections being adversely affected by erosion.

The remainder of the refuge has not received a professional archeological survey. A thorough survey of the cay is warranted, so that a reasonable resource management plan can be devised.

Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recommended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Buck Island | St. Thomas, U.S. Virgin Islands | -- | 0 | 0 | 0 | moderate |

Neither a historical study nor a systematic archeological survey has been conducted on Buck Island. However, a brief walkover survey of Buck Island was conducted in 1979 by Emily Lundberg and associates. This survey recorded a ruined twentieth-century structure that may have housed a quarantine station and a concentration of historic artifacts in an area reputed to have been a goat farm in the nineteenth century (Adams 1982). A comprehensive cultural resource survey to locate and identify sites is recommended for the refuge.

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Table 1 (cont'd)

| Refuge | Location | Survey | Known Prehist. Sites | Det'd Elig. or Listed Sites | Recom-mended Elig. Sites | Signif. Prehist. Site Potential |
|---|---|---|---|---|---|---|
| Cabo Rojo<br>Culebra<br>Desecheo | Puerto Rico | -- | 0 | 0 | 0 | moderate |

No surveys have been performed on any of the refuges in Puerto Rico, and there are no recorded sites for the three refuges (Karen Anderson, personal communication 1982). However, site potential for the refuges is considered high, and systematic archeological survey is recommended.

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# APPENDIX B

## RECOMMENDED WORK IN COASTAL WILDLIFE REFUGES, SOUTHEASTERN REGION

Appendix B gives survey priorities and testing and evaluation priorities for the prehistoric resources on the coastal refuges in the Southeast. The appendix is intended to complement Appendix A, which provides in greater detail the rationale behind many of the rankings.

Appendix B, like Appendix A, is subject to periodic revision. Most of the recommendations have been made on the basis of secondary sources. In many cases site information dates to the 1950s, and is tenuous at best. Sites listed as first or second priority may have been destroyed or extensively altered since the time the data was originally recorded, and these sites may no longer warrant further investigation. Thus, many of the rankings would probably change if more complete data on individual sites and refuges were known, but they are as close an approximation to reality as could be made given our current knowledge.

The appendix rarely touches the question of data recovery or preservation, and no priorities for treatment are offered. There are many sites in need of treatment, but in most cases site significance has not yet been evaluated and thus priorities can not now be established. However, until sites recommended as significant are evaluated, they must be afforded the same degree of protection as is given eligible sites (U.S. Fish and Wildlife Service 1982:5 RM 16.12).

## TABLE 2
## Recommended Work In Coastal Refuges, Southeastern Region

### PRIORITIES FOR SURVEY

### A. First Priority for Survey

| | |
|---|---|
| Chassahowitzka<br>Cedar Keys<br>Lower Suwannee | These refuges have high potential for significant prehistoric resources, and have had only limited, project-specific survey. With a majority of the known sites reported as adversely affected by erosion, further survey is needed to identify new sites and provide a basis for significance evaluations. |
| Bon Secour | Bon Secour Refuge has high potential for significant prehistoric resources, with many sites reported for the area. However, the refuge has had little professional survey. A majority of the known sites are adversely affected by erosion. Field survey is needed for the location of new sites and verification of old data. |
| Matlacha Pass<br>Pine Island<br>Island Bay | These refuges are in an area of high prehistoric site potential, and the majority of the known sites are adversely affected by erosion. There has been no professional survey of the refuges. Survey is needed to identify new sites, to verify old data, and to provide a basis for significance evaluation of known sites. |

Table 2 (cont'd)

B. Second Priority for Survey

| | |
|---|---|
| Swanquarter | Swanquarter has high potential for significant prehistoric resources, and has been subject to only limited, project-specific survey. Further reconnaissance survey, particularly of high potential areas, is recommended. |
| Cedar Island | Cedar Island has high potential for significant prehistoric resources, and has had only limited survey. Reconnaissance survey of unexamined portions of the refuge is recommended, and the marsh area west of Highway 12 should be checked for buried sites if development threatens. |
| Cape Romain | Cape Romain has high potential for significant prehistoric resources. The only survey in the refuge was project-specific, and covered only a small area. Further reconnaissance survey is recommended. |
| National Key Deer | National Key Deer has high potential for significant prehistoric resources, but survey coverage has been limited. Reconnaissance survey of the refuge is recommended. |
| St. Marks | St. Marks has high potential for significant prehistoric resources, and has had only limited, project-specific survey. Further reconnaissance survey of the refuge is recommended, followed by testing and evaluation of any endangered, potentially significant sites. |
| Crocodile Lake | Crocodile Lake has a moderate to high potential for significant prehistoric resources, and has had no professional survey. Reconnaissance survey of the refuge is recommended. |

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**Table 2 (cont'd)**

| | |
|---|---|
| Cabo Rojo<br>Culebra<br>Desecheo | The refuges in Puerto Rico have moderate potential for significant prehistoric resources, yet no surveys have been conducted on any of the three refuges. Thorough background and literature searches, together with reconnaissance surveys of the refuges, are recommended. |
| Buck Island<br>Green Cay | Neither of the two refuges in the Virgin Islands have been subject to a systematic archeological survey, yet both have potential for significant cultural resources. Reconnaissance survey of both refuges is recommended. |
| C. Third Priority for Survey | |
| Pinckney Island | Pinckney has been extensively surveyed in the past; no further reconnaissance survey is required. Intensive survey of certain areas may be necessary if development threatens. |
| Savannah | Savannah Refuge has had moderate survey coverage, but survey of the unexamined islands and of the land submerged during Marrinan's survey is recommended. |
| Wassaw | Survey of Wassaw Island has been extensive; only a few hammocks in the western portion of the refuge and parts of the western section of the main island have not been examined. Further survey is a low priority. |
| Blackbeard Island | Survey of Blackbeard Island has been extensive. Further reconnaissance survey of the refuge is a low priority, but intensive survey, testing, and monitoring of sites along Blackbeard Creek is recommended. |

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Table 2 (cont'd)

| | |
|---|---|
| Harris Neck | Survey of Harris Neck has been extensive. No further reconnaissance survey is required. Intensive survey may be necessary if development threatens to alter the area. |
| Merritt Island | The potentially significant sites in the Merritt Island Refuge apparently fall within the area of joint management between the Fish and Wildlife Service and the National Park Service. Clarification of this with the Park Service is recommended. |
| Pelican Island | All high probability areas have been examined. No further reconnaissance survey is required. However, intensive survey will be required if 8 Ir 51 is threatened by impact. |
| Hobe Sound | Survey of Hobe Sound, though not comprehensive, has covered most high probability areas. Further survey is a low priority when placed next to the need for testing of the Joseph Reed Mound. |
| Great White Heron | The tracts of land in the Great White Heron and Key West refuges are of low prehistoric site potential. Survey is a low priority. |
| J.N. "Ding" Darling | Survey coverage of "Ding" Darling has been fairly extensive, but further reconnaissance of wetlands and bay localities, both of which are high potential areas, is recommended. |
| Pinellas | Pinellas has moderate potential for significant prehistoric resources, but has had no professional survey. Reconnaissance survey is recommended. |

Table 2 (cont'd)

| | |
|---|---|
| St. Vincent | Survey coverage on St. Vincent has been extensive and most of the sites on the refuge have likely been identified. No further reconnaissance survey is recommended. |
| Mississippi Sandhill Crane | Mississippi Sandhill Crane has low prehistoric site potential. Though survey on the refuge has been limited, no further reconnaissance survey is recommended. However, the potential for buried sites should be considered if development threatens to impact the area. |
| Lacassine | Lacassine has high potential for significant prehistoric resources. However, most of the area not taken up in the 16,000 acre water impoundmant has been surveyed. Further survey of the refuge is of low priority. |
| Sabine | Sabine has moderate potential for significant prehistoric resources. However, most of the non-wetland areas have been surveyed. Further survey of the refuge is of low priority. |

## PRIORITIES FOR TESTING AND EVALUATION

### A. First Priority for Testing and Evaluation

| | |
|---|---|
| Hobe Sound | The Jospeh Reed Mound (8 Mt 13), a possible Late Archaic shell ring, half of which was destroyed in a single hurricane, should be tested to determine its cultural origin and significance. If the site is determined significant, a data recovery program to retrieve important information should be initiated. |

Table 2 (cont'd)

| | |
|---|---|
| Pine Island | Patricio Key (8 Ll 49), Cash Mound (8 Ch 38), and the John Quiet Mound (8 Ch 45), need testing and evaluation to determine site limits, site condition, degree of threat to site, and site significance. The Cash Mound is known to be adversely affected by erosion, but the condition of the other two sites is unknown. All are Calusa period shell mounds, and are in a region of southwest Florida rich in archeology but lacking in research. |
| Lower Suwannee | Shired Island West (8 Di 7), a potentially significant midden site with Late Archaic through Safety Harbor period components, is eroding into the Gulf. Testing and evaluation is needed to determine its significance. |
| Bon Secour | Site 1 Mb 50, which is on the south shore of Little Dauphin Island, was recorded in 1971 as a potentially significant Fort Walton period oyster shell midden with features and post molds clearly visible in the sand underlying the shell. The site was eroding into Dauphin Bay when it was recorded, and may have been destroyed when Hurricane Frederic struck the area in 1979. A field check to determine present site condition is needed, followed, if warranted, by a testing and evaluation program to determine its significance. |
| Lacassine | The Onion Hill site (16 Cm 6), one of the few primarily in situ middens still existing in the Chenier Plain region of southwest Louisiana, dates from the Tchula period to the early Mississippian period, a span of over 1,200 years. The site is eroding out of the west bank of Bayou Lacassine, and should be tested and evaluated to determine its significance. |

Table 2 (cont'd)

| | |
|---|---|
| Green Cay | The Green Cay site (12Avl-69), a large conch midden eroding out of a cutbank on the southeastern end of Green Cay, is potentially significant because of its size, location, unique use characteristics, and integrity. Because of the lack of information about the prehistoric utilization of the area, testing of the site is recommended. In the interim, a management program for the endangered portions of the site should be implemented. |

B. Second Priority for Testing and Evaluation

| | |
|---|---|
| Cape Romain | Several small shell middens are eroding into the Intracoastal Waterway. Testing and evaluation of these sites is recommended. |
| Pinckney Island | Site 38 Bu 66 has been tested and recommended eligible to the National Register. The most significant component of the site is being severely affected by erosion. Monitoring of the site is recommended, and possible treatment alternatives should be considered. Approximately 20 other middens along the perimeter of the island are reportedly being affected by erosion, and monitoring of the rate of destruction and evaluation of the sites is recommended. |
| Savannah | The First Refuge site (38 Ja 5) is eroding into the Back River. Field check to determine the present condition of the site, followed by testing and evaluation if necessary, is recommended. |
| Wassaw | Several small middens are eroding into the tidal creeks. Testing and evaluation of these sites is recommended. |

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Table 2 (cont'd)

| | |
|---|---|
| Blackbeard Island | Several small middens are eroding into Blackbeard Creek. Testing and evaluation of these sites is recommended. |
| National Key Deer | Field check of the Watson Hammock site (8 Mo 7) and an unnamed Calusa period site (8 Mo 245) is recommended. If the sites are endangered, testing and evaluation of the sites should become a priority. |
| Cedar Keys | Testing and evaluation of endangered, potentially significant sites identified in Dorian and Stoutamire's (1981) report is recommended. This could be part of a survey program for the three refuges in this region. |
| St. Vincent | Several middens are eroding along the north shore of the island. One of these middens, the Paradise Point site (8 Fr 71), has been tested by Braley (1982) and determined to be significant. Monitoring of the sites, and testing and evaluation, should be initiated. |

### C. Third Priority for Testing and Evaluation

| | |
|---|---|
| Cedar Island | Site CI-4 should be tested and evaluated if impacts threaten. In the interim, monitoring of the site to determine erosional damage is recommended. |
| Harris Neck | Limited testing may be required if new construction projects threaten to impact the untested portions of 9 McI 41 or other known resources. |
| Pelican Island | Site 8 Ir 51 should be tested and evaluated for eligibility if threatened by impact. |

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Table 2 (cont'd)

| | |
|---|---|
| Crocodile Lake | A field check of the 8 Mo 25, in conjunction with a survey of the refuge, is recommended. |
| Chassahowitzka | John's Island (8 He 15) and Site 8 Ci 147, both privately owned inholdings within the refuge, should be evaluated to determine their significance if they are purchased and brought under Federal protection. If erosion has not already destroyed the sites, they are likely significant. |
| Sabine | The Clubhouse site is likely a fill site rather than an *in situ* habitation site. However, a formal evaluation of the site will be required prior to any alterations. |
| | NO FURTHER WORK RECOMMENDED |
| Pea Island | Neither the field survey nor the background research conducted during Thompson and Gardner's (1979) survey gave any indication that the island had been occuppied prehistorically. No further investigations concerning prehistoric resources are needed; work on historic resources may be required. |
| Tybee | Tybee Refuge, a 100 acre marsh island 75 percent covered with dredge spoil, has no known prehistoric sites and minimal potential for significant sites. No further work is recommended. |
| Wolf Island | Wolf Island, which is 75 percent salt marsh, has no known sites and minimal archeological site potential. Survey of the refuge is of low priority. |

Table 2 (cont'd)

| | |
|---|---|
| Passage Key | Because of the geological history of Passage Key, which is now little more than a sandbar, no intact archeological sites are likely to be present on the island. No archeological investigations have been conducted on the refuge, and none are recommended. |
| Egmont Key | A survey by Grange (1977) indicated that Egmont Key has low potential for intact archeological sites. No further survey for prehistoric archeological resources is recommended. The entire island is listed on the National Register as a historic site, however, and erosion and public use activity is severely affecting the historic resources. |
| Delta | Delta has no reported prehistoric sites and none are expected. No further work on prehistoric resources is required. |
| Breton | The Breton Islands are not likely to have any significant prehistoric resources. No further work on cultural resources is recommended. |
| Shell Keys | Shell Keys has no known prehistoric sites and none are expected. No further work is recommended |

# END

5/01/84